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CONTENTS

Housing the Bell System
H. P. Charlesworth

Federal Reserve System Statistics
F. E. Richter

World's Telephone Statistics

Economic Notes, Second Quarter 1926

Abstracts of Recent Technical Papers from Bell System Sources

Notes on Recent Occurrences

Organization Changes

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AND A RECORD OF PROGRESS

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Housing the Bell System

WE ARE celebrating this year the telephone's fiftieth birthday. As we look back over this relatively brief span of time we can not but be impressed by the signs on every hand of the phenomenal growth and progress in the industry. The great advancements in the art of communication itself, through the comprehensive development and research activities carried on by the System, and the marked progress made in the construction and operating activities all form interesting stories in themselves. Similarly, there has been great progress in the other essential and related phases of the business, the scope of which at first is perhaps scarcely realized.

Among the more important of these related activities is that of housing all the component parts of this vast enterprise. There are close to 6,000 buildings in the System ranging in size from small and isolated repeater stations on the western prairies housing the apparatus which makes communication possible from coast to coast, to huge combination office and equipment buildings in the midst of metropolitan traffic, through a list

comprising garages, warehouses, factories, shops, office buildings and even hospitals. It doubtless will be of interest, therefore, to review the character and scope of the housing phase of the System's activities starting with the famous garret in Court Street, Boston.

In the earliest days of the telephone service, the housing problem was a simple one. A very small switchboard, simple in character and easily moved if necessary, was placed in some convenient location, usually in rented quarters, and from that switchboard wires were run one by one as needed either on poles or over housetops to the premises of those desiring service.

It will be seen, therefore, that in these early days, the housing activities were substantially no different in a particular city than those of the local merchant. Most any space fairly centrally located with respect to the customers to be served was entirely suitable, particularly as no undue expense or inconvenience was involved in relocating the equipment and wires and personnel. It may be of interest to mention here that the first commercial telephone central office was established at New Haven in 1878, and occupied, as did a great many subsequent offices in different parts of the country, a few hundred feet of space in rented quarters.

In a relatively few years, however, as the telephone became more and more a part of the community life the picture changed. The rapid increase in the number of subscribers brought about the necessity for more elaborate and expensive switchboards, which in turn introduced more exacting requirements as to the location and character of the building space. This problem multiplied as the art developed, each subsequent advancement introducing new problems in the building phase of the work. In fact, only within the last few years, important changes in the art such as improved transmission developments and the dial telephone brought about fundamental problems not heretofore encountered.

How different, then, is the problem of today, par-

ticularly in the large cities. Each of the buildings must be placed in some definite location, and it is necessary to plan this well in advance and to direct the growth of the plant toward that location even though the building may not be erected for some years. Otherwise, very serious and costly rearrangements of plant would be necessary at the time the office is opened. Furthermore, each building must be planned to fit the particular circumstances surrounding the central office in question. Not only must very careful consideration be given to the erection of the immediate building, but the plans must provide for ready expansion to care for the telephone growth without excessive cost or reaction on the service. Moreover, suitable real estate at the theoretical wire center may be unobtainable in some cases, in which event studies must be made weighing the costs of various available sites near the wire center against the varying lengths of conduit and cable runs involved in each case.

The extent of our building activities is perhaps most strikingly illustrated by the structures shown in Figure 1, which portrays an imaginary city composed of Bell Telephone buildings.

Of course, the bulk of our buildings are used for housing central office switchboards and associated personnel and the records indicate that the Schenley central office building at Pittsburgh erected in 1886 was one of the first, if not the very first, building planned and erected for this purpose.

With the Schenley building as a background let us survey the situation as of today. There are some 2,000 or so of these company-owned properties, representing a capital investment of close to $50,000,000 in land and something over $200,000,000 in buildings. Their aggregate area is well over 30,000,000 square feet, of which about 75% is in non-combustible buildings, and in addition to providing for central office switchboards, they provide working space for about 250,000 employees.

The scope of the construction activities involved in the erection of these numerous buildings is apparent. However, perhaps a few facts as to the magnitude of the housekeeping involved in their upkeep will be of particular interest.

The Bell System keeps house just as truly as a housewife does, but on a gigantic scale. It requires the entire working time of over 6,000 people to insure that all company-owned buildings are adequately heated, lighted, cleaned and serviced. It requires the services of close to 2,500 people to cook for and wait upon Bell System employees who secure lunch or other meals in telephone buildings—in fact, this is another closely related activity which would make an interesting story in itself. Hundreds of electricians, machinists, carpenters, painters, and other mechanics are regularly employed for the making of minor alterations, repairs and replacements.

Aside from those engaged in the architectural and construction phases of the work, there are several hundred telephone engineers in the System whose principal activities are concerned with the problems involved in planning central office buildings. A new building of this character involves consideration of the relative advantages of the different pieces of property available. It includes the preparation and careful examination of preliminary plans covering the more promising building and equipment arrangements which might be employed for the property finally acquired.

The facility with which these layouts could be expanded from time to time as required to care for growth, the advantages from an operating and maintenance point of view, and the relative costs are carefully weighed. The most desirable scheme is then fully developed. This requires careful study in collaboration with the architect and the other departments of the company of a great variety of interesting problems ranging from each detail involved in the arrangement of the central office equipment to the broader considerations affecting

the occupancy of the different floors throughout the entire life of the building. These engineering plans when completed form the basis for the architectural plans and for the specifications covering the requirements for engineering, manufacturing and installing the central office equipment.

Protection against fire is, of course, one of the most important considerations involved in planning our buildings. Next to the safety of the personnel, continuity of service is the main objective. The most approved fire resisting devices such as metal and wire glass windows, hollow steel doors, extra strong partitions enclosing shafts and exits, and rolling steel shutters for openings facing hazardous exposures are employed. In addition, very complete fire fighting appliances are provided in all buildings.

Finally, in connection with the architectutal phases, whether the building be in a small community or in a metropolitan center, constantly increasing consideration is given to the desirability of having it display individuality and character consistent with its surroundings. Also, where landscaping is appropriate, careful attention is given to beautifying the grounds. Our buildings from the very nature of the telephone problems must be more or less centrally located with respect to the subscribers served, and many of them therefore, must be placed in residential areas. In these cases in particular, stress is laid on insuring that the building and grounds be appropriate to their surroundings.

Figures 2, 3 and 4 illustrate typical central office buildings such as are provided in large and small communities throughout the System.

Up to this point the discussion has centered around the buildings housing the operating activities. The manufacturing branch of the System—the Western Electric Company—presents another interesting phase of this housing problem. The requirements to be met

here are, of course, of a substantially different character from those of the operating companies.

Moving about 1878 from LaSalle Street, to larger quarters in Kinzie Street, Chicago, the personnel employed by the firm which later became the Western Electric Company consisted of perhaps 100 people occupying about 12,000 square feet of floor space. In a span of a little less than 50 years, this has expanded to the enormous manufacturing plants at Hawthorne and Kearny and to the 34 distributing warehouses located strategetically throughout the country and engaged solely in the manufacture and supply of telephone facilities.

Figure 5 shows a general view of the Hawthorne works which contain close to 4,000,000 square feet of floor space and provide working space for some 41,000 employees.

The existing construction at Kearny already develops close to 800,000 square feet of space and the coming Fall will see completed and occupied something over 1,000,000 square feet in the aggregate. Approximately 2600 employees are now engaged at Kearny. Figure 7 shows the development of the Kearny works.

Also beside these tremendous areas at Hawthorne and Kearny, the manufacturing department occupies at other localities a little more than 600,000 square feet, substantially all of which is leased space. This space was taken over as a direct result of the Western Electric Company's extensive participation in the activities brought about by the European War and according to the present plans will all be replaced by new space at Kearny.

It is of interest to note that the 34 distributing warehouses contain in themselves 1,800,000 square feet of floor space. Each distributing house must, of course, be located suitably with respect to the center of distribution for telephone supplies and also from the standpoint of satisfactory transportation facilities. Figure 10 shows one of the large eastern distributing houses.

In a word, the Western Electric Company today occupies in round numbers over 7,400,000 square feet of floor space, 75 per cent. of which is in company-owned buildings. Area figures in the Western Electric case must be almost meaningless if expressed only in square feet. A better appreciation can be obtained of what it means to house so vast an enterprise as the manufacturing and distributing branches of the Bell System when it is pointed out that the area comprised by this 7,400,000 square feet is equivalent to 170 acres.

When it is considered that the housing problems of the Western Electric Company range from foundries and iron working shops on the one hand to shops for the turning out of most intricate precision instruments on the other, and comprise wood, fabric and wire working mills, it will be seen how wide and comprehensive must be the scope of these housing activities.

Factory planning as practiced today by the Western Electric building engineers was unknown when their problems first became apparent, and their solution, allied with the advance in the art of telephony are a most valuable contribution to the science of factory engineering in general.

Still another phase of the housing problem of the System is that of providing space for administrative, research and laboratory purposes.

The Bell Telephone Laboratories building at West and Bethune Streets, New York, is shown in Figure 9. Within the past year the original structure has been increased in size to take care of the increasing volume of research work. The building as it stands contains about 600,000 square feet of floor space devoted wholly to laboratory purposes and to housing the more than 3,500 scientists, engineers and assistants who are engaged in every phase of the development and research work. Also the building houses a most complete and valuable display of historical telephone apparatus, and has in the top story an auditorium with a seating capacity

of about 1000. It is interesting to compare all this with the few hundred square feet of floor space which sufficed for Dr. Bell and his one assistant in Court Street, Boston.

The headquarters building of the American Telephone and Telegraph Company at 195 and 205 Broadway, New York, is shown in Figure 8. This building is 26 stories high and contains roughly 600,000 square feet of floor space, about 500,000 of which are used by the 5,000 or so telephone employees engaged in the general departments of the American Company and the Western Electric Company.

Many other large buildings are required for the administrative staffs of the operating companies. The last year has seen the completion or start of four outstanding Bell System structures located in New York, Cleveland, St. Louis and San Francisco. These buildings, which are shown in Figures 11, 6, 12 and 13, represent an investment aggregating close to $35,000,000. The combined productive floor area is roundly 1,600,000 square feet—which is about 37 acres. Their aggregate volume is close to 40,000,000 cubic feet—or about the volume which would be developed by a pyramid 450 feet square at the base and extending upward somewhat beyond the height of the Washington monument. The size of these structures does not, of course, reflect a desire for large buildings, but rather indicates the vastness of the enterprise. An appreciation of this is obtained when it is realized that the aggregate plant investment of the four companies whose administrative staffs are housed in these buildings is over a billion dollars and that space is also available to house central office switchboards for some 300,000 stations. This is equivalent to the number of telephones in a city having a population of 1,500,000.

These four buildings represent different treatments of the new architectural design, developed in America to give beauty and distinction to the so-called skyscraper.

1. A telephone city—one-fifth of the buildings owned by the Bell System. 2. A multi-unit office in a residential district. 3. A multi-unit office in a metropolitan business district. 4. A small suburban office

5. The Hawthorne (Ill.) plant of the Western Electric Company. 6. The new administration building in Cleveland of the Ohio Bell Telephone Company. 7. The Kearny (N. J.) plant of the Western Electric Company

8. The headquarters of the American Telephone and Telegraph Company at 195 Broadway, New York. 9. The Bell Telephone Laboratories, New York. 10. A large Eastern distributing warehouse for telephone supplies

11. The new administration building in New York of the New York Telephone Company. 12. The new administration building in St. Louis for the Southwestern Bell Telephone System. 13. The new administration building in San Francisco of the Pacific Telephone and Telegraph Company

Where a many-storied building is necessary in order to utilize to the best advantage valuable land, it has been found in this country that such a building can be made so architecturally fine that it becomes an object of pride to the community as a whole. Such buildings not only are attractive in themselves, but they also exemplify the high ideals of the Bell System.

Telephone building history from the first New Haven office with its few hundred feet of leased space to these tremendous office and equipment buildings of today, contains an absorbing record of the development of the housing phase of the System's activities. The great structures shown are striking examples of the way in which the Bell System has grown in this relatively brief span of fifty years.

H. P. CHARLESWORTH.

Federal Reserve System Statistics

A TELEPHONE plant which operates efficiently on a normal Sunday morning in May in a dull year gives little clue to a student of the key problems of the telephone industry, or of particular exchanges. No winter sleet storms or extreme summer heat, no peak-load traffic, daily or seasonal, no labor shortage should make operations difficult. Nothing but insufficient personnel, let us say, or some exceptional and quite unforeseeable circumstances, should prevent excellent service being given. A thousand things contribute to that good service, none of which is particularly evident, perhaps, because things are running so smoothly and there are no stresses or strains in the operating machinery. Watch operations in a peak-load hour, or at a time when an unexpected catastrophe in a community makes almost everybody in the community want to use the telephone at the same time, and any weaknesses will soon be evident enough, and with them the significance of this or that engineering or operating factor will soon appear.

The banking machinery of the country is generally operating so smoothly that we do not stop to realize the contributions made to this smooth operation by the federal reserve system. Yet it has now become such an integral part of our banking and credit machinery that if the significance of federal reserve system operations and statistics is not understood, it is not possible to comprehend the essential developments in one of the primary factors in the economic and business life of the country, namely banking and credit conditions.

Before the war, the principal statistics that we had, other than of money rates and domestic exchange rates, which gave a clue to the significance of the operations of our tens of thousands of then uncoordinated banks were either of infrequent issue or more or less local in character. An example of the former was the compilation of the Comptroller of the Currency, based on reports of

national banks, published about five times a year, of the principal assets and liabilities of the national banking system as a whole and of the national banks in certain cities. Among the data of more or less local significance were the weekly figures published by the clearing house associations in some of the larger cities, showing in one way or another the condition of the members of the individual associations. Naturally the statistics published by the New York Clearing House dominated those of all the others in importance and were consulted each week to see whether the New York banks had an excess of reserves above legal requirements, or a deficit below legal requirements, whether the ratio of loans to deposits was greater or less than one, and whether the cash holdings had increased or decreased. Any indication that the credit situation at New York was seriously tightening or definitely easing as a result of specie movements between New York and the rest of the country, or of changes in the relative positions of loan and deposit items, might be expected, other things being equal, to have a repercussion elsewhere in the country. The rigid system of reserves and the factor of the lack of a coordinating agency for the thousands of banks, as well as the mere factor of the geographical extent of the country, all made for banking machinery characterized by jolts and jars and slow-acting shock absorbers. No statistics were available weekly which made any pretense at representing the country as a whole, but even if there had been, they could not possibly have been as useful as under a coordinated banking system like the present one.

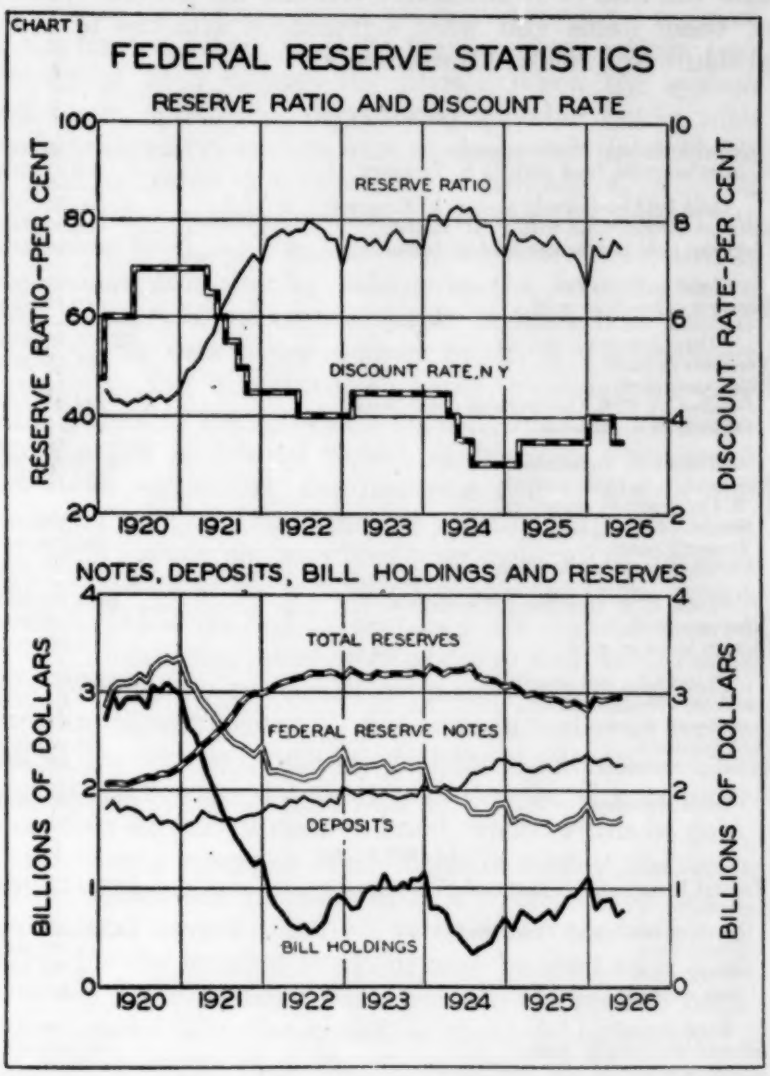
The present brief article aims to suggest, in the rather cursory manner which the limitations of space permit, the significance of some of the statistics relating to the operations of the federal reserve system that are now available. These statistics are issued weekly and reflect in one way or another the operations of a system whose member banks represent two-thirds of the total commercial banking resources of the country.

The Federal Reserve System

Federal reserve banks are twelve in number, located each within its own federal reserve district; the twelve districts covering the 48 states. All national banks within each district must, and commercial (as against savings) banks organized under state laws may (if they meet certain requirements) become members of the federal reserve system by becoming stockholders of the reserve bank in that district. As far as the law goes, member banks *must* have current dealings (other than those involved in check collections) with their respective federal reserve banks only to the extent that, for national banks, deposits in the federal reserve banks constitute the only legal reserves, while for other member banks, reserve deposits must be carried in the federal reserve banks representing the same percentage of the member banks' own deposit liabilities as is required of national banks in the same localities. A federal reserve bank has dealings only with its member banks, with other federal reserve banks, and with the United States Government, except in so far as it does business with bill brokers or other financial houses, in its open-market transactions, and except for certain types of business (of minor importance, for the purposes of this review), such as those with foreign central banks or with federal intermediate credit banks. No federal reserve bank may receive deposits from or lend money to commercial banks which are not its own "members" or stockholders, whether in its own district or in other districts. Neither may a federal reserve bank act as a banker for individuals; reserve banks being entirely bankers' banks and fiscal agents for the U. S. Treasury.

Chart 1 shows the course of various federal reserve system items since 1920. These items and others will be referred to and discussed in what follows. Before entering on that discussion, we may reproduce here what might be called a consolidated balance sheet for the

federal reserve system for June 2, 1926. The principal resources, or asset items, to which attention will be drawn, are as follows: total gold reserves, total bills



discounted, bills bought in the open market, holdings of U. S. Government securities, total holdings of bills and securities. The principal liabilities which will concern

us are federal reserve notes and member-bank reserve-account deposits. The reserve ratio and the rediscount rate will also be of interest. What is the genesis of each of these items and what significance attaches to their absolute and relative movements?

RESOURCES

Gold with Federal Reserve agents	$1,450,150,000
Gold redemption fund with U. S. Treasury	52,511,000
Gold held exclusively against F. R. notes	$1,502,661,000
Gold settlement fund with F. R. Board	662,400,000
Gold and gold certificates held by banks	632,169,000
Total gold reserve	$2,797,230,000
Reserves other than gold	149,250,000
*Total reserves	$2,946,480,000
Non-reserve cash	47,134,000
Bills discounted:	
Secured by U. S. Government obligations	284,841,000
Other bills discounted	240,116,000
*Total bills discounted	$524,957,000
Bills bought in open market	244,143,000
U. S. Government securities:	
Bonds	103,106,000
Treasury notes	169,846,000
Certificates of indebtedness	131,200,000
*Total U. S. Government securities	$404,152,000
Other securities	3,885,000
Foreign loans on gold	8,900,000
*Total bills and securities	$1,186,037,000
Due from foreign banks	691,000
Uncollected items	693,424,000
Bank premises	59,665,000
All other resources	17,828,000
Total resources	$4,951,259,000

LIABILITIES

*Federal Reserve notes in actual circulation	$1,704,136,000
Deposits:	
*Member bank-reserve account	2,225,270,000
Government	15,792,000
Foreign bank	4,295,000
Other deposits	15,833,000
Total deposits	$2,261,190,000
Deferred availability items	625,602,000
Capital paid in	122,670,000
Surplus	220,310,000
All other liabilities	17,351,000
Total liabilities	$4,951,259,000

*Most important items reflecting banking and business conditions.

It will be seen from the balance sheet that the deposit liabilities of the system are almost entirely those of the member banks. It will be recalled that member banks' deposits in the reserve banks constitute the legal reserves of the former, which must be kept up to a certain percentage of their deposit liabilities. When the system first began operations, deposits by member banks with the federal reserve system were made entirely in the form of gold or other lawful money. Nowadays, when a member bank wishes to build up its reserve account at its reserve bank, and has no surplus cash to deposit, it may accomplish this by taking to the federal reserve bank high grade commercial paper or bank bills that it holds, or its own notes secured by U. S. Government obligations, and discount such paper, receiving the proceeds thereof in the form of a deposit credit, in the same way that an individual would, at his own commercial bank. In explaining the meaning and origin of the liability "member-bank reserve-account deposits," we have thus already shown where practically all of the cash reserves and all of the bills discounted come from, except for the gold deposited in exchange for federal reserve notes. To be sure, member banks may and do discount bills at federal reserve banks not merely in order to build up their deposit accounts, but also in order to secure cash at the reserve banks for over-the-counter use or for domestic or foreign shipment. Conversely, if a member bank has a surplus of cash on hand, whether this be gold, federal reserve notes, or other forms of money, the most natural disposition to make of it is to deposit it in the local federal reserve bank where it either may count as reserve for the member bank, or may be used to pay off debts which the member bank owes to the reserve bank in the form of bills discounted, as these debts mature.

Chart 1 shows that the fluctuations in the deposit item over the last six years have been relatively small, with a gradual upward trend since the end of 1920 dominating the movement of this item. The deposit curve

is much the least widely fluctuating curve on the chart, and the upward trend of this curve reflects primarily the growth of the system and of the deposit liabilities of the member banks against which they must have reserve-account deposits in the federal reserve banks. Its week-to-week fluctuations, to be sure, tend to forecast week-to-week fluctuations that will appear later in deposits of reporting member banks.

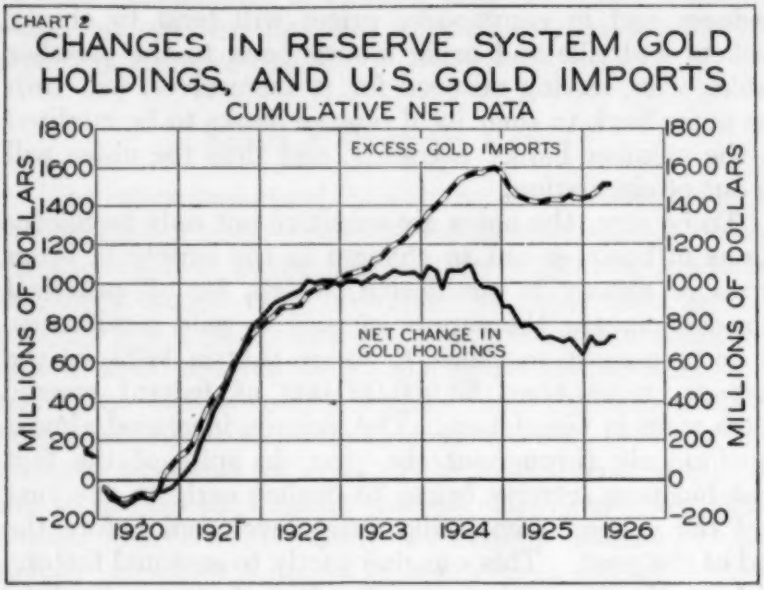
Federal Reserve Notes

The other important liability on the balance sheet is that of federal reserve notes in actual circulation. Before the organization of the federal reserve system, the most important single type of money in circulation in this country was gold certificates. Federal reserve notes are now in hand-to-hand circulation in greater amount than any other form of money in the United States, and have been almost ever since we entered the war. One of the important reasons for creating the federal reserve system was to furnish the country with an elastic currency. The federal reserve notes supply the needed element of elasticity. All other forms of currency in this country tend to be either absolutely inelastic or relatively so, over both long and short periods of time. Federal reserve notes may be secured at any federal reserve bank by a member bank in much the same way that an individual gets cash from his bank,—either by drawing down its reserve account or by discounting its own note or rediscounting with its endorsement eligible paper and taking the proceeds in the form of the required notes, or by depositing some other form of cash. The federal reserve bank, in order to issue the notes, must deposit with its federal reserve agent collateral to the same amount as the note issue, either in the form of notes or bills held by the bank, or in the form of gold or gold certificates. The notes are issued and get into general circulation simply to the extent that member banks who need cash secure it in this

form from the federal reserve banks. Active business and general prosperity will cause increased demands for pocket and till money on the part of individuals, firms and banks, and will thus cause the volume of federal reserve notes in circulation to rise; while a recession in business and in commodity prices will tend to empty pockets and tills and bring money back to the member banks, who, having no need for it themselves, will turn the notes back to their local reserve banks to be credited to the member banks' accounts, and thus the notes will go out of circulation.

To be sure, the notes are sensitive not only to fluctuations in business but to changes in the supply of other forms of money in circulation, which, for all practical purposes, means the supply of gold or gold certificates. If we turn again to Chart 1, we see that in 1920, on the average, more than $3,000,000,000 of federal reserve notes were in circulation. The volume increased almost continuously throughout the year, in spite of the fact that business activity began to decline early in the year and the general commodity price level well before the end of the year. This was due partly to seasonal factors, and partly to a characteristic lag of many banking factors after business factors. A sharp decline occurred in 1921, and further declines since then, in spite of the recent remarkable prosperity in this country, have brought the volume of notes in circulation down to $1,704,000,000, as shown on the balance sheet of June 2, 1926. For this, the decline in prices after the inflation of 1919–1920 is only partly responsible. Chart 2 tells most of the rest of the story. It shows cumulative changes in the net gold movement to and from this country, and in gold holdings of the federal reserve system, since December, 1919. Since the end of 1920 there have been net imports of gold into this country of nearly $1,400,000,000, practically all of which has found its way to the federal reserve banks, and ever since 1922 the federal reserve system has pursued the

policy of getting this gold out into circulation and drawing in federal reserve notes, with the result that, whereas on January 1, 1921, the gold and gold certificates in circulation in this country outside the federal reserve system



amounted to about $450,000,000, as compared with $3,349,000,000 of federal reserve notes, on May 1, 1926, the respective figures were $1,554,000,000 and $1,663,-000,000. Thus the total amount of these two types of money in circulation was only 15% less on May 1, 1926, than on January 1, 1921, but federal reserve notes amounted to only 52% of the total at the later date, as compared with 88% of the total at the earlier date.

Open Market Operations: Earning Assets

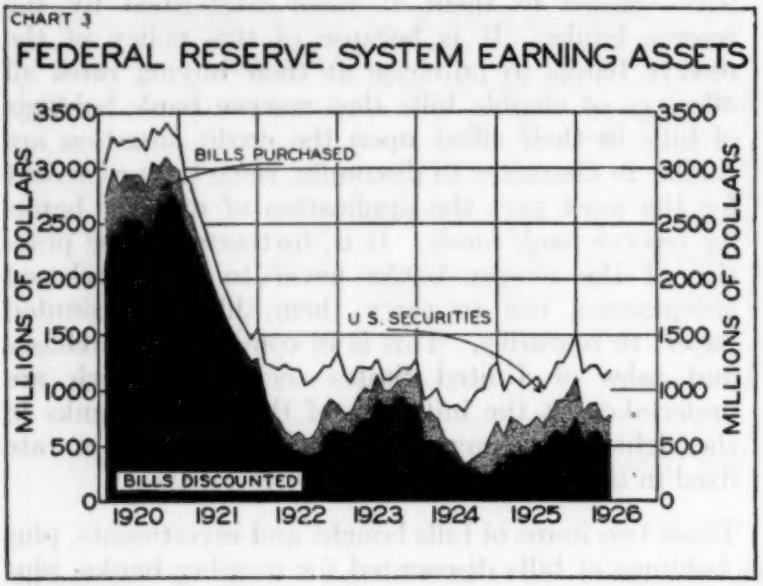
The two asset items of bills bought in the open market and holdings of United States Government securities represent the bulk of the reserve banks' open market operations. It is worth while here to quote a paragraph

from the Annual Report of the Federal Reserve Board for the year 1925, on the subject of reserve policy in regard to bills or acceptances:

> "In pursuance of their policy of encouraging the acceptance market, the reserve banks have stood ready at all times to purchase such eligible bills as were offered to them at rates established by the reserve banks. It is because of this policy of the reserve banks to purchase at their buying rates all offerings of eligible bills that reserve bank holdings of bills in their effect upon the credit situation are similar in character to discounts, since they represent for the most part the application of member banks for reserve bank funds. It is, furthermore, the practice of the reserve banks never to sell purchased acceptances, but to carry them, like rediscounted paper, to maturity. This is in contrast to purchases and sales of United States securities, which are undertaken at the initiative of the reserve banks in the light of the general credit situation at a rate fixed in the market."

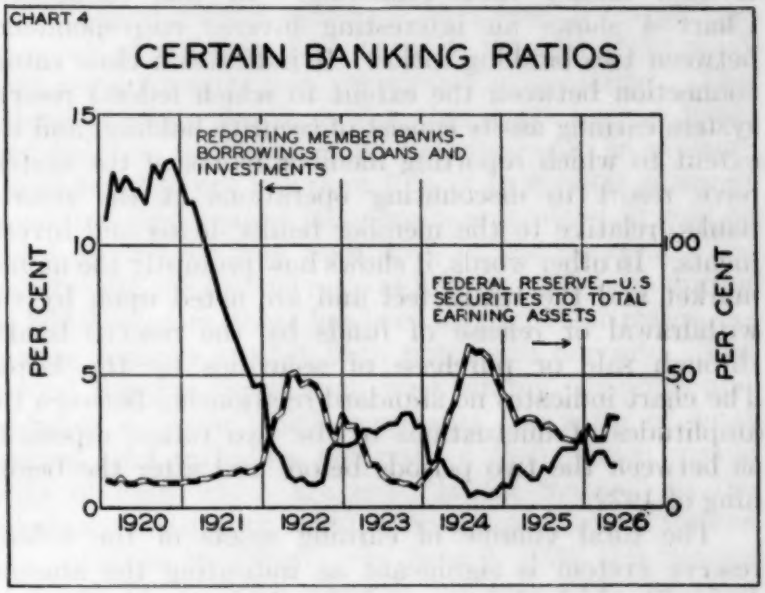
These two items of bills bought and investments, plus the holdings of bills discounted for member banks, plus the minor items of other securities and foreign loans on gold, represent the total earning assets, so-called, of the reserve banks, those assets from which the banks' earnings come, as against the barren cash which they hold in their vaults, which earns nothing. The Act creating the federal reserve system wisely provided that the stock in the federal reserve banks, held by member banks, should never pay more than 6% dividends. This takes away from the reserve banks much temptation that there might be to increase unduly their earning assets in order to raise or keep up dividend rates to high figures, when prudence would dictate another policy. Chart 3 indicates the composition of earning assets, monthly since January, 1920, as between bills discounted, bills bought

in the open market, and holdings of United States Government securities. (The small amount of other earning assets may be neglected.) There is naturally an interplay between the two principal types of earning assets, those which the member banks originate and those which the federal reserve banks acquire on their own initiative.



That is to say, if, because of a slackening in business or because of gold imports, the member banks, with surplus funds on hand, begin to reduce their borrowings at the federal reserve banks, and thus cause one group of the earning assets of the banks to diminish, the reserve banks may endeavor, however successfully or otherwise, to maintain the volume of their earning assets by purchasing Government securities in the open market. On the other hand, if the reserve banks on their own initiative decide to increase their investments, say in United States Government securities, they directly or indirectly put funds in the hands of member banks, in paying for the securities bought; and much or all of these

funds are pretty likely to find their way with little delay back to the federal reserve banks, often to pay off member banks' debts, and so reduce the reserve banks' holdings of bills discounted. Thus the total volume of earning assets may be but little affected, though their composition is distinctly changed. Chart 3 shows remarkable stability



of total earning assets since early 1922, if one bears in mind all that has happened since then, in the way of business fluctuations, gold imports, and so on.

Again, the federal reserve banks may decide to influence the money market, in order to head off inflation or to check undue use of credit, or for whatever reason, and yet they may not for the time being wish to go as far as to raise the rediscount rate, the rate at which they will discount or rediscount eligible paper brought to them by the member banks. In this case they could and at times do, dispose of some of their investments. This takes surplus funds out of the market and thus causes the member banks either to have greater recourse

to discounting operations at the federal reserve banks or to sell some of their own security holdings, or to reduce their lending commitments, in order to restore their reserve position; and when this happens on any scale, business men and speculators both are rather certain to find accommodation less liberally granted at banks and to find money rates stiffening. In this connection, Chart 4 shows an interesting inverse correspondence between two banking ratios. It indicates a close causal connection between the extent to which federal reserve system earning assets consist of security holdings and the extent to which reporting member banks of the system have resort to discounting operations at the reserve banks, relative to the member banks' loans and investments. In other words, it shows how promptly the money market and the banks feel and are acted upon by the withdrawal or release of funds by the reserve banks, through sale or purchase of securities by the latter. The chart indicates no standard relationship between the amplitudes of fluctuations of the two ratios, especially as between the two periods before and after the beginning of 1922.

The total volume of earning assets of the federal reserve system is significant as indicating the amount or credit which the system is furnishing to the country and to its banking system. This is so because of the interplay between the types of earning assets to which reference has already been made. We have seen that as long as member banks are borrowing from the federal reserve banks, fluctuations in the volume of investments of the latter are likely to be reflected in opposite fluctuations in the borrowings by the member banks. The federal reserve system therefore furnishes credit equal to the total of its earning assets, whatever may be the composition of those assets. If this country should go along for some time with virtually no movements of gold either in or out of the country, the fluctuations in total earning assets would have a much clearer and more

direct significance for students of business conditions than they have possessed in the last five years, when they have been relatively stable.

Reserve Ratio; Discount Rates

A word now as to the meaning of the reserve ratio of the federal reserve system. Theoretically we should not speak of a system reserve ratio; actually there is no harm done to economic proprieties in so doing. The Federal Reserve Act provides that each reserve bank must hold, as reserves against its note issue, an amount of gold equal to not less than 40% of such notes as are in circulation, and against its deposits an amount of gold or lawful money not less than 35% of the deposits. Especially with the reserve ratio as high as it has been during the last five years, there has been no particular reason for figuring reserves against both notes and deposits. The Federal Reserve Board each week simply computes and publishes a figure which represents the ratio of total reserves (not including non-reserve cash, which means forms of cash which are not "lawful money" in the technical sense of that term) to deposit and federal reserve note liabilities combined. On June 2, 1926, this reserve ratio was 74.3%. All through the year 1920 the ratio hovered around or below 45%, and during that year a number of the reserve banks would have had to pay and to apply to their borrowing customers certain penalties provided in the Act, for having deficient reserves, had not the Act also provided that federal reserve banks might discount bills for one another. Thus in 1920 reserve banks which had surplus funds took for discount bills from other reserve banks whose reserves were below the legal minima. Ever since the autumn of 1921 the reserve ratio for the system has been above 70%, with the exception of a few weeks in December, 1925, and fluctuations in a ratio as high as this, under present banking and economic conditions in this country, have practically

no significance whatever, unless there is a prolonged movement of the ratio in one direction or another. Especially lacking in significance are the characteristic seasonal fluctuations in the ratio, notably the drop that practically always occurs just before Christmas, as a result of the great demand for currency at that time.

There has yet to be discussed the matter of the federal reserve discount or rediscount rates. Each reserve bank, by the action of its own directors, fixes its own discount rates, the rate or rates at which it will discount or rediscount paper for its member banks; changes in rates being subject to approval by the Federal Reserve Board at Washington. When the bill which created the system was under discussion, one of the most strongly stressed arguments put forward in favor of a system of regional banks, as against a single central bank, was that the economic heterogeneity of various parts of the country made it desirable to have different rediscount rates prevailing as between the various sections: what would be a high and therefore drastically regulatory rate for New York might be a low rate for the Rocky Mountain region. As a matter of fact, during most of the life of the system, rates for the twelve districts have either been identical or within a per cent. of each other. The New York rate has generally though not always been the lowest, or as low as any other rate, and, of course, its movements ordinarily command more attention, within and without the country, than those of all the others combined. The preeminent importance of New York among our cities as the domestic financial center and as an international money market, especially in these post-war times, is, of course, responsible for this. It is the New York rate whose changes are shown on Chart 1.

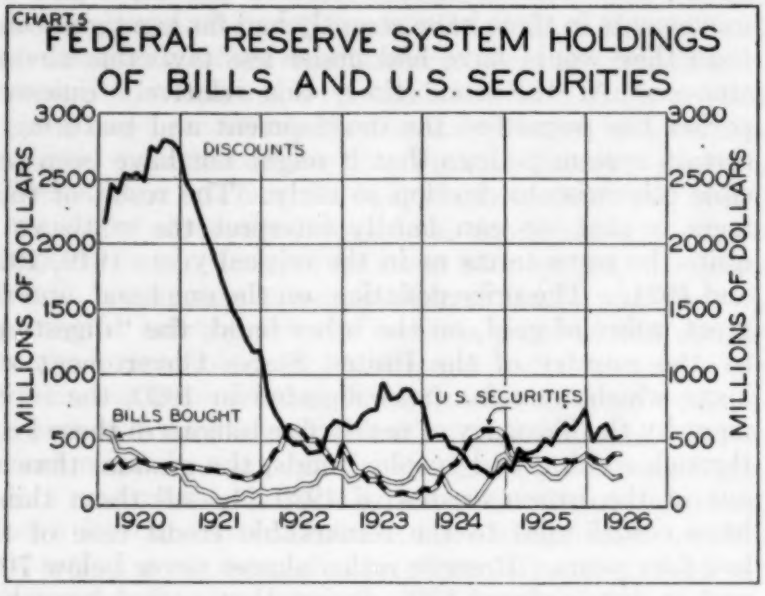
What Statistics Are Most Significant?

What has so far been written has been in the main descriptive only and has made only passing comment

on the relative significance of the various statistics mentioned. What can be said on this score?

The operations of the federal reserve system during the last few years have been carried on under general economic conditions so free from serious stresses or strains (except that of absorbing an enormous inflow of gold!), that certain federal reserve statistics and the movements in them have recently had far less significance than they would have had under less favorable circumstances. At the same time, this relatively quiescent period has permitted the development and maturing of certain system policies that it might not have been possible otherwise to develop so early. The result of these facts is that we can hardly interpret the statistics in quite the same terms as in the critical years 1919, 1920, and 1921. The price deflation, on the one hand, and the great influx of gold, on the other hand, the "digesting" by the country of the United States Government war loans which were far from digested in 1920, the retirement by the Treasury of nearly five billions of these loans through sinking and surplus funds, the gradual thawing out of the frozen credits of 1920–21,—all these things have contributed to the remarkable credit ease of the last four years. Reserve ratios almost never below 70% and at times above 80% during that period have had little or no significance and still have little. A dozen years ago, no intelligent writer would have dared to predict that in 1925, after ten years' operation of the system, the fluctuations in the reserve ratio would have so little meaning. If anything, the variations in the member-bank reserve-account deposit item have even less value, at least as a long-run index of either banking or general business conditions. Changes in the gold reserves, since the end of 1920, have generally indicated primarily how successful the system has been in getting back into circulation gold that was pouring into the reserve banks from almost all quarters of the globe. Even the item of federal reserve notes in circulation, which ought to

show sensitive elasticity, both expansive and contractive, has, because it has been so greatly under the influence of the system policy as to gold, given only slight clue, of other than seasonal character, to business activity. The five items which above all others have held significance have been the discount rates, the holdings of discounted



bills, the holdings of purchased bills, and the holdings of United States Government securities, and the total volume of earning assets. Of the last we have already spoken briefly, and nothing further will be added here.

As has been pointed out, the middle three of these five items constitute the bulk of the reserve banks' total earning assets. Chart 5 presents these in a different way from that in which they were shown in Chart 3, where they appeared in the form of an area chart. From Chart 3 we saw that ever since January, 1922, there have been mainly seasonal fluctuations in earning assets as a whole, except for the marked decline in 1924 and the rather sharp peak at the close of 1925. Both Charts

3 and 5 indicate that the composition of the total volume of earning assets has varied greatly from time to time. Least important in the size of fluctuations of the components have been the changes in the portfolio of bills bought, as Chart 5 shows. There is a definite seasonality of movement here. Bills are bought in almost all cases because banks and dealers desire to sell them to the reserve banks at the buying rates which the latter have established, which are generally slightly above the open market bill rates. The majority of these bills or acceptances are created in connection with foreign trade, and the usual autumn increase in exports brings about a creation of bills, and some of these find their way to the reserve banks. Expanding and contracting domestic trade activity also affects, through the volume of commodities in storage against which bills are drawn, the volume of bills purchased by the banks.

Of much greater significance are the fluctuations in the volume of bills discounted for the account of member banks. In the six years covered by the charts this item has shown fluctuations—with a distinct lag, in every case save one—corresponding to the major movements in general business activity. There has been a definite and interesting shortening of the lag during the six years and the recent turn downward of the curve apparently shows no lag at all as compared with the turn in general business. (There is a seasonal factor in the "bills discounted" curve which it is difficult to make precise allowance for; hence the word "apparently.") Equally interesting is the downward trend in the curve throughout the period, in spite of the notable increase in the volume of business transacted in this country, at relatively stable prices, during the last five years, and in spite of the increase in the volume of bank credit extended to business by the commercial banks of the country in that time. For this, the great gold imports of the period are in no small degree responsible, since the receipt of these by member banks of the federal reserve system

and their deposit by member banks in the federal reserve banks, has enabled the member banks to reduce or to abstain from expanding their borrowings at the reserve institutions. The slight upward trend in the reserve banks' security holdings is probably also partly responsible.

The lag in the item of bills discounted, behind movements of general business, is perhaps no more than is characteristic of banking series in general. The absence of lag at the opening of 1926 is probably due at least in part to a sharp decline at that time in the amount of loans extended by member banks to stock market operations, coming after a prolonged increase in such accommodations in 1924 and 1925. This is so, notwithstanding the fact that federal reserve banks may not lend money to member banks on customers' paper secured by stocks or bonds; member banks may use other types of paper (including their own notes) as a basis for borrowing operations at the reserve banks. It will be of interest to watch the timings of future turns in this curve and to seek to analyze the reasons therefor. It is true, of course, as has earlier been noted, that there is an interplay between the movements of this curve and those of the curve showing federal reserve banks' investments. A marked increase or decrease in the investments will of itself tend to bring about, almost automatically, a reverse movement in the former, sooner or later, though movements in the "bills discounted" item are not certain to be automatically reflected in fluctuations in reserve bank investments.

Money Market Influence

This brings us to the third curve on Chart 5, that of holdings of United States Government securities. When the Federal Reserve Act was passed in 1913, there was, of course, not the slightest notion that in even the remote future this country would have a national debt of over $20,000,000,000, or that the Government would have a

floating debt measured by the billions, which could be used by the federal reserve banks or by anybody else as a money market stabilizer. Nor was there any attempt by the federal reserve system to use its holdings of Government securities to feed funds into or drain funds out of the market until 1922. At the close of 1921, as Chart 5 shows, the investment holdings of the federal reserve system went down to about $200,000,000, and the bill holdings, which had a year previously been at about $3,000,000,000, had declined to about $1,250,000,000, and were still decreasing fast. There seemed to some to be a need to build up earning assets in order that the expenses of the reserve banks might be met, especially with money rates declining, and the desire to help member banks to liquidate also played a large part. The reserve system then began to accumulate Government securities, until before the end of the second quarter in 1922 it had increased its investment portfolio to over $600,000,000. Still total earning assets had gone below $1,250,000,000. They have remained there ever since, as Chart 3 shows, except for the intervening Decembers and except for certain other weeks in the autumn of 1925. From about the middle of 1922 on to the beginning of 1925, the curve of security holdings on Chart 5 goes counter to the curve of bills discounted and goes counter to the course of commercial paper rates and, with a lag, to the course of general business activity. In other words, as the volume of business has increased, the federal reserve system has during at least part of that period sold securities, thus taking funds out of the market and adding its influence to that of general business in causing the member banks to have increased resort to discounting operations at the federal reserve banks and in causing money rates to firm up.

If a comparison is made of the curve of security holdings with the curve on Chart 1, which shows the discount rate at the Federal Reserve Bank of New York, it will be seen that purchases and sales of securities have

preceded by a considerable period of time changes in the discount rate. Thus the reserve system was taking funds out of the market during the whole second half of 1922 (except for a more or less seasonal shift in December), but it was not until February, 1923, that the New York Bank raised its discount rate. It was as early as the end of 1923 that the reserve system began to put funds back into the market, but not until April, 1924, did the first reduction in the discount rate take place. In the case of the next reverse process, the selling of securities began in November, 1924, while the discount rate was not raised until February, 1925. The investment policy of the reserve system during the year 1925 gave no inkling to the increase in the discount rate in January, 1926, though purchases of securities preceded the cut in the discount rate three months later. But it is clear that generally during the last four years the reserve system has tended to follow a policy akin to that in vogue for many years in the Bank of England, of endeavoring, if possible, to influence the market by open-market operations, and only resorting to changes in the discount rate after open-market conditions had clearly got out of line with the central bank rate.

Now as to what "out of line" means,—that is a question which has provoked much argument. In the early years of the system, discount rates were normally above rates on commercial paper, time loans and bankers' acceptances. Now they tend to be below all other rates, except those on bankers' acceptances and on short-term Government securities, and, in periods of very easy money, call money. The bankers' acceptance is that form of paper which in this country most nearly corresponds with the bill in London. The Bank of England keeps its rate above the bill market rate, and the Federal Reserve Bank of New York aims to pursue a similar policy. There are not wanting those who feel that the New York rate should be above the commercial paper rate, as well as above the bill rate. This consideration

would be of greater importance if the banks took advantage of the low discount rate to borrow large sums of money at all times, which they would then try to lend at a profit at the highest market rates. As a matter of fact, the tradition was quickly built up that banks should in normal times keep "out of the federal reserve bank," except to meet seasonal and other temporary needs, and the typical borrowing by most of the large banks is for very short periods, such as a day or two. In general, the movements of the federal reserve discount rates tend to follow rather than lead the market, just as they generally follow the federal reserve's regulation of the supply of funds in the market through purchases and sales of Government securities. The significance of changes in the federal reserve discount rates seems to lie in the fact that they indicate that reserve system authorities either want to recognize a definite shift in the money market (up or down), or want to warn not only the money market but business in general not to proceed too fast with further expansion, or want to accomplish some specific end, such as the influencing of foreign exchange rates through the influencing of New York money rates, or the movement of funds between different centers in this country.

It is not the purpose of this article to discuss federal reserve policy, but simply to endeavor to set forth some aspects of it, and to call attention to some of the present banking and business significance of the important federal reserve statistics. Questions of the evolution of reserve policy or of the probable future development of that policy will therefore not be considered. The whole matter of relationship of federal reserve policy to international finance, and in particular to Bank of England policies and to the regulation of sterling exchange, and also the question of the relationship, if any, between federal reserve policies and price stabilization in this country are not within the bounds of the present article.

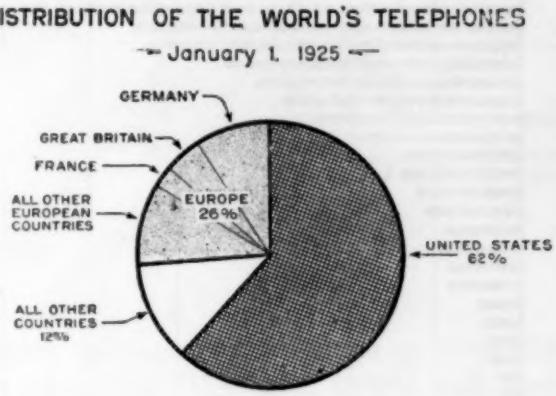
As was indicated early in the review, this is but a

cursory examination of a large subject. Much has been left untouched. Nothing has been said of the significance of the component parts of the gold reserve, simply because it was desired to concentrate attention on the significance of the principal large categories of the federal reserve system balance sheet. More important still, no attempt has been made to analyze the statistics of the individual reserve banks. This latter would constitute a study in itself and would throw interesting light on regional differences of banking and business conditions. Finally, it has not been possible to link up federal reserve statistics with the interesting statistics that are available covering the operations of the member banks of the federal reserve system. This, too, deserves an exposition at greater length than available space affords.

F. E. Richter.

World's Telephone Statistics
January 1, 1925

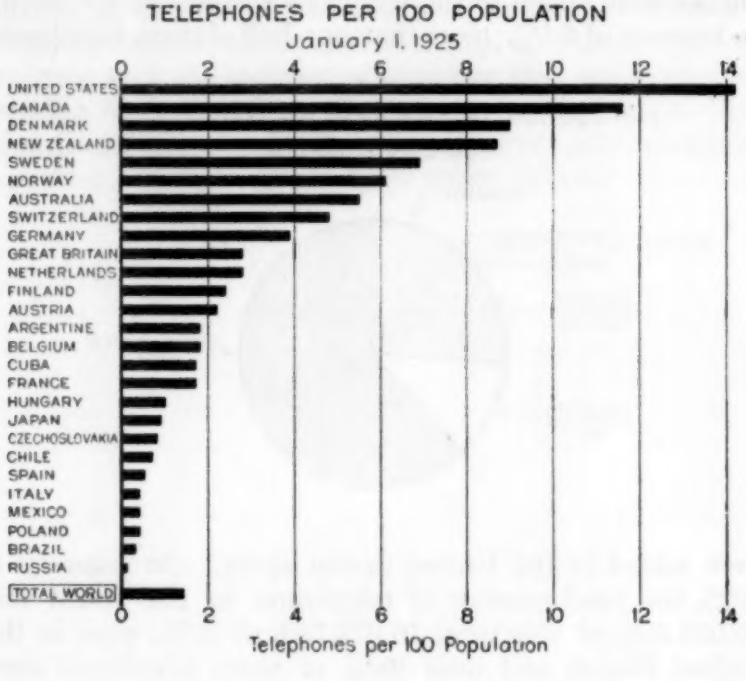
A STATISTICAL survey of telephone growth throughout the world during 1924 shows little change in the relative status of the various countries in point of the extent and the use of telephone facilities. During the year a net total of 1,589,670 telephones were added to the telephone systems of the world, an increase of 6.5%; more than one-half of these telephones



were added in the United States alone. On January 1, 1925, the total number of telephones in the world was 26,038,508; of this total 16,072,758, or 62%, were in the United States, and over 98% of these telephones were connected to the Bell System. Europe had 6,895,365 telephones, or 26% of the world's total; while 3,070,385 telephones, comprising the remaining 12% of the total, were distributed among the countries of Asia, Africa, Oceania, South America, and North America outside of the United States.

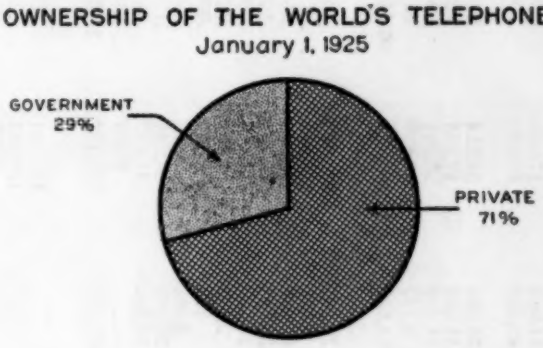
These figures are taken from the latest annual compilation of telephone and telegraph statistics of the world,

prepared by the Chief Statistician's Division of the American Telephone and Telegraph Company on the basis of authoritative information collected through correspondence with telephone officials in all foreign countries. This compilation, embracing statistics for all countries as of January 1, 1925, has recently been issued in pamphlet form, and the accompanying tables and charts are reproduced from this pamphlet.



From the table showing "Telephone Development of the World, by Countries," it can be seen that the United States is still far ahead of all other countries both in the absolute number of telephones and in the number of telephones in proportion to population. On January 1, 1925, there were in this country 14.2 telephones for each 100 inhabitants. Canada, with 11.6 telephones per 100 popu-

lation, ranked second in point of development. Denmark with 9.0 came third, and was followed by New Zealand with 8.7, Sweden with 6.9, and Norway with 6.1. In both Canada and Denmark, which are next in rank to the United States in the extent of telephone facilities in proportion to population, the great majority of the service is operated by private enterprise. In fact, only 29% of the



world's total telephones were under government ownership, the remaining 71% being owned and operated by private companies. Germany, which ranks next to this country in absolute number of telephones, had only 3.9 telephones per 100 inhabitants, as compared with 14.2 in the United States. In Great Britain there were only 2.8 telephones per 100 population, and in France only 1.7. Russia, with its 150,000,000 people, had only 150,000 telephones. In Spain, where the government telephone service was transferred to a private company a few years ago, the gain in telephones in 1924 was comparatively large, but the field for further development is indicated by the fact that at the beginning of 1925 Spain still had only 0.5 telephones per 100 inhabitants. Europe as a whole, with 1.4 telephones per 100 population, had only one-tenth of the telephone density of the United States.

TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES

January 1, 1925

	Number of Telephones					
	Government Systems	Private Companies	Total	Per Cent. of Total World	Telephones per 100 Population	Increase in Number of Telephones during 1924
NORTH AMERICA:						
United States	.....	16,072,758	16,072,758	61.73%	14.2	839,407
Canada	202,089	870,365	1,072,454	4.12%	11.6	63,251
Central America	6,317	11,613	17,930	.07%	0.3	926
Mexico	1,749	49,231	50,980	.19%	0.4	620
West Indies:						
Cuba	700	54,214	54,914	.21%	1.7	7,128
Porto Rico	780	11,334	12,114	.05%	0.9	672
Other W. I. Places*	3,992	11,269	15,261	.06%	0.3	147
Other No. Am. Places*	75	3,733	3,808	.01%	1.1	143
Total	215,702	17,084,517	17,300,219	66.44%	11.2	912,294
SOUTH AMERICA:						
Argentine	.....	173,605	173,605	.66%	1.8	16,564
Bolivia	.....	1,824	1,824	.01%	0.1	—400*
Brazil	587	97,977	98,564	.38%	0.3	4,718
Chile	.....	30,895	30,895	.12%	0.7	623
Colombia	.....	14,923	14,923	.06%	0.2	3,460
Ecuador	1,691	2,827	4,518	.02%	0.2	.....
Paraguay	183	278	461	.002%	0.04	69
Peru	.....	9,552	9,552	.03%	0.2	412
Uruguay	.....	25,241	25,241	.10%	1.5	1,057
Venezuela	527	10,520	11,047	.04%	0.4	497
Other Places	2,527	.....	2,527	.01%	0.5	214
Total	5,515	367,642	373,157	1.43%	0.5	27,214
EUROPE:						
Austria	145,141	.....	145,141	.56%	2.2	9,302
Belgium	136,944	.....	136,944	.53%	1.8	22,137
Bulgaria	8,097	.....	8,097	.03%	0.2	814
Czechoslovakia	115,738	.....	115,738	.44%	0.8	12,132
Denmark	12,066†	295,911	307,977	1.18%	9.0	15,207
Finland	.....	83,000	83,000	.32%	2.4	3,000
France	660,127	.....	660,127	2.53%	1.7	56,341
Germany	2,385,177	.....	2,385,177	9.16%	3.9	142,845
Great Britain and No. Ireland	1,264,024	.....	1,264,024	4.85%	2.8	115,929
Greece*	5,450	.....	5,450	.02%	0.1	50

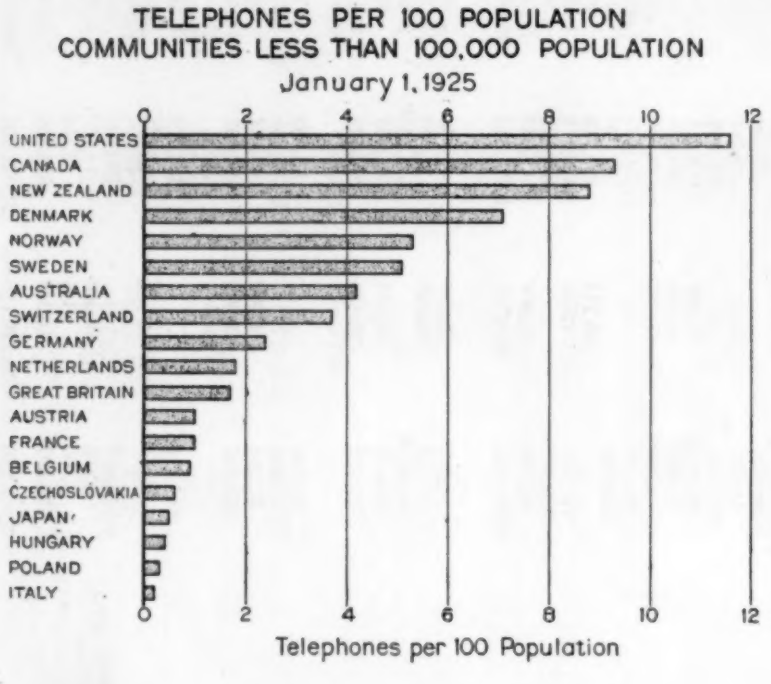
Hungary	78,612	.....	78,612	.30%	1.0	3,405
Irish Free State (March 31, 1925)	21,641	.....	21,641	.08%	0.7	373
Italy*	‡	172,900‡	172,900	.66%	0.4	20,000
Jugo-Slavia*	27,500	.....	27,500	.11%	0.2	1,500
Latvia (March 31, 1925)	15,557	.....	15,557	.06%	0.8	4,199
Netherlands	202,868	.....	202,868	.78%	2.8	9,600
Norway	97,433ƒ	71,085	168,518	.65%	6.1	1,510
Poland	75,000*	44,985	119,985	.46%	0.4	9,837
Portugal	2,300*	17,456	19,756	.08%	0.3	897
Roumania	34,580	.....	34,580	.13%	0.2	2,965
Russia, including Siberia *	150,000	.....	150,000	.58%	0.1	19,722
Spain	.....	105,213	105,213	.40%	0.5	15,000*
Sweden	416,584	1,734	418,318	1.61%	6.9	15,929
Switzerland	189,429	.....	189,429	.73%	4.8	9,149
Other Places in Europe*	45,346	13,467	58,813	.23%	0.7	2,247
Total	6,089,614	805,751	6,895,365	26.48%	1.4	494,090
ASIA:						
British India (March 31, 1925)	14,785	26,455	41,240	.16%	0.01	2,390
China*	77,844	34,226	112,070	.43%	0.03	10,645
Japan (March 31, 1925)	544,433¶	.....	544,433¶	2.09%	0.9	71,628
Other Places in Asia*	88,610	16,055	104,665	.40%	0.1	9,913
Total	725,672	76,736	802,408	3.08%	0.1	94,576
AFRICA:						
Egypt	33,808	.....	33,808	.13%	0.2	2,945
Union of South Africa†	71,448	.....	71,448	.27%	1.0	6,265
Other Places in Africa*	47,044	1,203	48,247	.19%	0.04	4,662
Total	152,300	1,203	153,503	.59%	0.1	13,872
OCEANIA:						
Australia (June 30, 1924)	318,279	.....	318,279	1.23%	5.5	36,576
Dutch East Indies	36,272	2,997	39,269	.15%	0.1	682
Hawaii	.....	17,707	17,707	.07%	6.2	891
New Zealand (March 31, 1925)	120,097	.....	120,097	.46%	8.7	8,656
Philippine Islands*	2,550	13,200	15,750	.06%	0.1	750
Other Places in Oceania*	2,309	445	2,754	.01%	0.2	69
Total	479,507	34,349	513,856	1.98%	0.7	47,624
TOTAL WORLD	7,668,310	18,370,198	26,038,508	100.00%	1.4	1,589,670

* Partly estimated. †March 31, 1925. ƒJune 30, 1924.

‡ As all local telephone service was transferred to private companies during 1925, the estimated number of telephones is shown under Private Companies.

¶ Excludes 23,800 telephones temporarily out of service as a result of the earthquake.

In South America the best developed country from a telephone standpoint was Argentine, with 1.8 telephones per 100 population. In Asia the majority of the telephones are in Japan, but even so the Japanese had slightly less than one telephone per 100 persons. In the "dark continent" of Africa there is still little in the way of telephone service except in the Union of South Africa, which had one telephone per 100 inhabitants.



The table on "Telephone Development of Large and Small Communities," showing the relative extent of telephone facilities in large urban centers as compared with the less populated districts, draws attention to one of the striking differences between conditions here and abroad. The figures for the telephone development of communities under 100,000 population, given in the last column of this table, are also shown graphically in the accompanying

TELEPHONE DEVELOPMENT OF LARGE AND SMALL COMMUNITIES

January 1, 1925

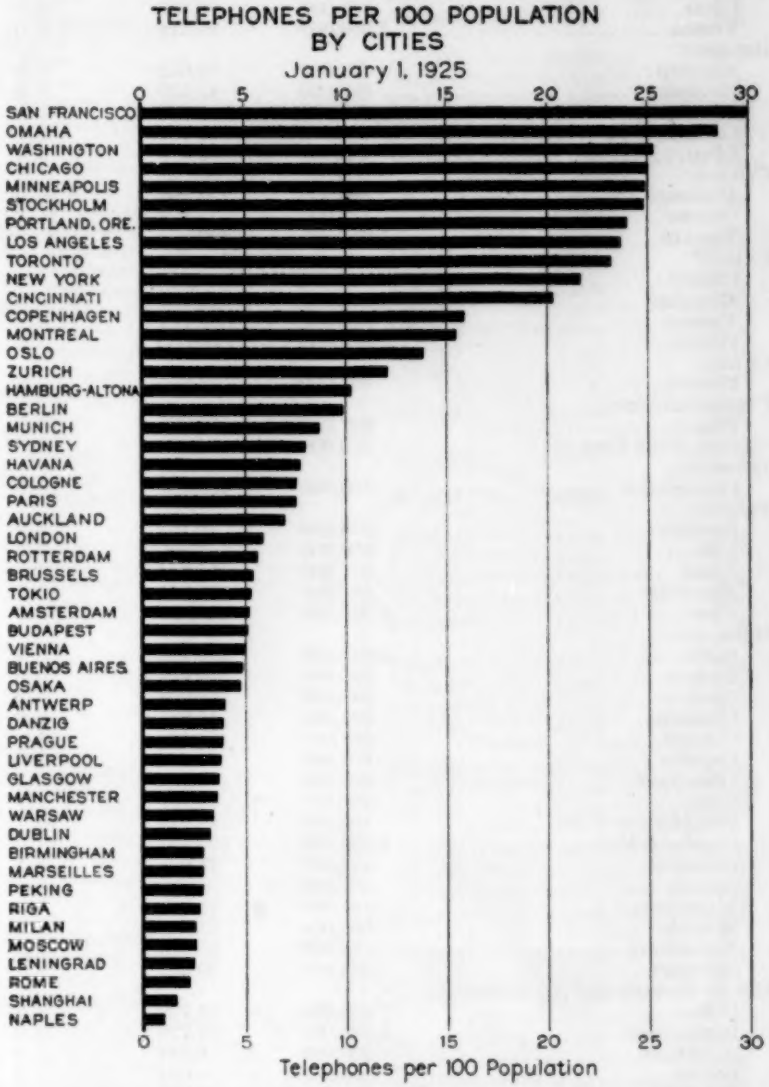
Country	Service Operated by (See Note)	Number of Telephones		Telephones per 100 Population	
		In Communities of 100,000 Population and Over	In Communities of less than 100,000 Population	In Communities of 100,000 Population and Over	In Communities of less than 100,000 Population
Australia	G.	199,228	137,050*	7.6	4.2
Austria	G.	100,477	44,664	4.9	1.0
Belgium	G.	87,394	49,550	3.8	0.9
Canada	P. G.	416,689	655,765	19.3	9.3
Czechoslovakia	G.	35,535	80,203	3.8	0.6
Denmark	P. G.	119,078	188,899	15.9	7.1
France	G.	331,704	328,423	5.3	1.0
Germany	G.	1,270,646	1,114,531	8.1	2.4
Great Britain and Northern Ireland ‡	G.	930,766	362,231	3.9	1.7
Hungary	G.	52,447	26,165	4.5	0.4
Italy (June 30, 1923)	P. G.	80,406	62,197	1.5	0.2
Japan (March 31, 1925)	G.	290,352	254,081	3.7	0.5
Netherlands	G.	107,289	95,579	5.6	1.8
New Zealand (March 31, 1925)	G.	35,553	84,544	8.5	8.8
Norway (June 30, 1924)	P. G.	36,908	131,610	13.9	5.3
Poland*	P. G.	53,320	66,665	2.6	0.3
Sweden	G.	151,278	267,040	19.3†	5.1
Switzerland	G.	64,693	124,736	11.3	3.7
United States	P.	7,352,826	8,719,932	19.1	11.6

Note: P. indicates telephone service operated by private companies, G. by the Government, and P. G. by both private companies and the Government.
†The majority of this development is due to Stockholm.
*Partly estimated.
‡March 31, 1925.

chart, "Telephones per 100 Population—Communities Less Than 100,000 Population." It is evident from this chart that in the United States the smaller communities are well served telephonically, for these communities had 11.6 telephones per 100 population. Canada, New Zealand, and Denmark ranked next to this country in the extent of telephone equipment in the smaller communities. All other countries, however, show a comparatively poor telephone development in the smaller places; for in most foreign countries telephone service is confined largely to the urban centers, and rural service, as it exists in this country, is almost unknown. This concentration of service in the larger cities in the case of foreign countries is also indicated by the table on "Telephone Development of Cities." For example, taking the figures in this table in conjunction with those in the table showing the telephone development of the world by countries, we find that London, with 432,303 telephones, had more than one-third of all the instruments in Great Britain; and that Paris, with 226,552 telephones, had one-third the total number in all France. Even Germany, with its otherwise progressive rural communities, had more than 25% of its telephones concentrated within the four cities of Berlin, Cologne, Hamburg, and Munich.

But despite the concentration of telephones in the larger cities in foreign countries, the accompanying chart on "Telephones per 100 Population, by Cities," shows that the telephone development of foreign cities is very much less than that of cities in the United States. For instance, on the basis of the number of telephones per 100 population, New York had more than 3½ times as many telephones as London, and Chicago had more than 3 times as many as Paris. Indeed, the only foreign city having a telephone development commensurate with that of United States' cities is Stockholm, which had 24.8 telephones per 100 inhabitants. The telephone development of Stockholm, however, was exceeded by that of San Francisco, with 29.9 telephones per 100 persons, Omaha with 28.5,

Washington with 25.3, Chicago with 25.0, and Minneapolis with 24.9. In fact, with the exception of Germany, the number of telephones in the whole of every foreign country



Note: This chart shows the comparative telephone development of the largest cities in the countries listed in the table on "Telephone Development of Cities." The United States cities shown include, in addition to New York and Chicago, a number of representative cities having a population between 200,000 and 1,000,000.

TELEPHONE DEVELOPMENT OF CITIES

January 1, 1925

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones per 100 Population
ARGENTINE:			
Buenos Aires	2,000,000	97,838	4.9
AUSTRALIA:			
Adelaide	290,000	22,778	7.9
Brisbane	245,000	16,945	6.9
Melbourne	886,000	67,734	7.6
Sydney	1,008,000	80,900	8.0
AUSTRIA:			
Gratz	155,000	6,159	4.0
Vienna	1,900,000	94,318	5.0
BELGIUM:			
Antwerp	490,000	19,662	4.0
Brussels	887,000	47,528	5.4
Charleroi	212,000	4,269	2.0
Ghent	280,000	5,957	2.1
Liege	410,000	9,978	2.4
CANADA:			
Montreal	799,000	123,994	15.5
Ottawa	173,000	31,404	18.2
Toronto	615,000	142,292	23.2
CHINA:*			
Canton	918,000	2,800	0.3
Shanghai	1,545,000	23,011	1.5
Tientsin	824,000	7,704	0.9
Peking	1,339,000	39,035	2.9
CUBA:			
Havana	494,000	38,696	7.8
CZECHOSLOVAKIA:			
Prague	697,000	26,870	3.9
DANZIG, FREE CITY OF	373,000	14,440	3.9
DENMARK:			
Copenhagen	750,000	119,078	15.9
FRANCE:			
Bordeaux	274,000	10,757	3.9
Lille	206,000	8,706	4.2
Lyons	577,000	15,844	2.7
Marseilles	601,000	17,251	2.9
Paris	2,980,000	226,552	7.6
GERMANY:			
Berlin	3,948,000	392,172	9.9
Bremen	286,000	25,621	9.0
Breslau	548,000	33,934	6.2
Chemnitz	321,000	19,017	5.9
Cologne	687,000	52,460	7.6
Dresden	605,000	46,270	7.6
Düsseldorf	428,000	32,766	7.7
Essen	460,000	18,907	4.1
Frankfort-on-Main	456,000	48,749	10.7
Hamburg-Altona	1,236,000	127,783	10.3
Hannover	412,000	28,077	6.8
Leipzig	657,000	53,435	8.1
Magdeburg	287,000	18,282	6.3
Munich	668,000	57,946	8.7
Nuremburg	382,000	28,903	7.6
Stuttgart	335,000	30,333	9.1
GREAT BRITAIN AND NO. IRELAND:†			
Belfast	426,000	11,720	2.8
Birmingham	1,324,000	37,720	2.9
Blackburn	258,000	6,243	2.4
Bolton	290,000	6,634	2.3
Bradford	391,000	16,003	4.1
Bristol	421,000	12,598	3.0
Edinburgh	436,000	19,777	4.5
Glasgow	1,311,000	48,387	3.7
Hull	337,000	14,426	4.3
Leeds	557,000	16,939	3.0
Liverpool	1,238,000	46,493	3.8
London	7,354,000	432,303	5.9
Manchester	1,655,000	59,954	3.6
Newcastle	621,000	16,547	2.7
Nottingham	347,000	11,554	3.3
Plymouth	240,000	5,041	2.1
Sheffield	525,000	14,386	2.7

*Partly estimated.
†March 31, 1925.

TELEPHONE DEVELOPMENT OF CITIES—(Concluded)

January 1, 1925

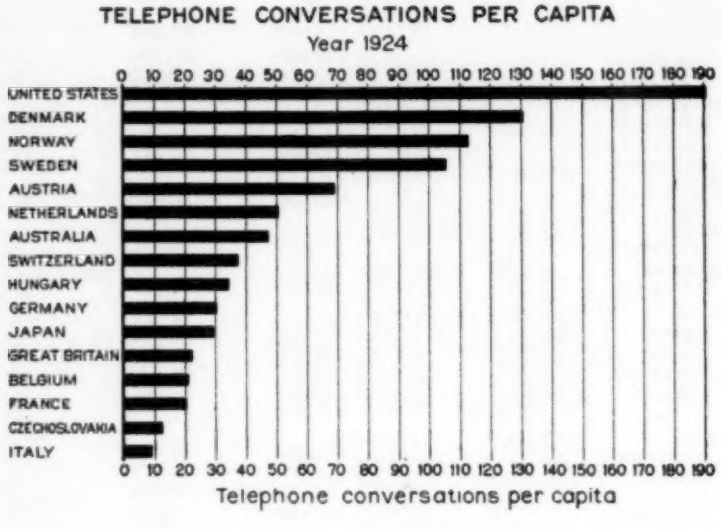
Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones per 100 Population
HUNGARY:			
Budapest	953,000	48,680	5.1
Szegedin	113,000	2,083	1.8
IRISH FREE STATE:#			
Dublin	402,000	12,650*	3.2
ITALY:‡			
Milan	714,000	17,992	2.5
Naples	785,000	6,786	0.9
Rome	648,000	14,261	2.2
Turin	509,000	7,953	1.6
JAPAN:#			
Kobe	727,000	22,627	3.1
Kyoto	681,000	21,448	3.1
Nagoya	671,000	18,938	2.8
Osaka	1,532,000	72,967	4.8
Tokio	1,917,000	102,457	5.3
Yokohama	390,000	7,124	1.8
LATVIA:#			
Riga	338,000	9,090	2.7
NETHERLANDS:			
Amsterdam	712,000	37,019	5.2
The Hague	391,000	27,430	7.0
Rotterdam	544,000	30,693	5.6
NEW ZEALAND:#			
Auckland	181,000	12,581	7.0
Christchurch	118,000	9,425	8.0
Wellington	118,000	13,547	11.5
NORWAY:†			
Oslo	265,000	36,908	13.9
POLAND:			
Warsaw	950,000	32,747	3.4
ROUMANIA:			
Bucharest	361,000	10,200	2.8
RUSSIA:			
Kazan	162,000	1,498	0.9
Kharkov	325,000	3,100	1.0
Leningrad	1,093,000	26,256	2.4
Moscow	1,558,000	39,078	2.5
Odessa	327,000	1,884	0.6
SPAIN:			
Barcelona	716,000	17,342	2.4
Madrid	756,000	16,067	2.1
Seville	206,000	1,727	0.8
Valencia	233,000	4,029	1.7
SWEDEN:			
Göteborg	230,000	27,963	12.2
Malmö	116,000	14,291	12.3
Stockholm	439,000	109,024	24.8
SWITZERLAND:			
Basel	137,000	13,652	10.0
Berne	105,000	11,696	11.1
Geneva	128,000	14,626	11.4
Zurich	205,000	24,719	12.1
UNITED STATES:**			
New York	6,059,000	1,315,368	21.7
Chicago	2,967,000	741,883	25.0
Los Angeles	1,100,000	260,567	23.7
Total of the 8 cities with over 1,000,000 population	17,251,000	3,588,629	20.8
San Francisco	675,000	201,515	29.9
Cincinnati	649,000	131,541	20.3
Milwaukee	587,000	112,254	19.1
Total of the 9 cities with 500,000-1,000,000 population	5,912,000	1,075,832	18.2
Washington	468,000	118,278	25.3
Minneapolis	443,000	110,420	24.9
Portland, Ore	330,000	79,221	24.0
Omaha	218,000	62,007	28.5
Total of the 30 cities with 200,000-500,000 population	8,735,000	1,622,564	18.6
Total of the 47 cities with over 200,000 population	31,899,000	6,287,025	19.7

#March 31, 1925. *Partly estimated. ‡June 30, 1923. †June 30, 1924.

**There are shown, for purposes of comparison with cities in other countries, the total development of all cities in the United States in certain population groups and the development of certain representative cities within each of such groups.

is exceeded by the number in at least one single American city. Thus, New York had over 50,000 more telephones than all of Great Britain, Chicago 80,000 more than France, Los Angeles over 57,000 more than The Netherlands, and San Francisco over 28,000 more than Italy.

The comparative use of telephone service during 1924 is indicated by the chart on "Telephone Conversations Per Capita." Of the countries shown, the United States heads the list with 191 conversations per capita. Next in rank



are the Scandinavian countries: Denmark with 131 per capita, Norway with 113 and Sweden with 106. Germany, with 30 conversations per capita, is well down on the list, but exceeds Great Britain with 23, France with 20, and Italy with only 9.

Economic Notes, Second Quarter 1926

IN DECIDING to return to the gold standard, internationally, on July 1, Canada is now following the example set by the other self-governing British dominions and by Great Britain herself. Gold has flowed rather freely between Canada and the United States for some years, in spite of the fact that Canada was not on a gold basis. A system of earmarking gold which had been worked out by the bankers made this possible. Students of the situation feel that the substantially increased output of gold by Canadian mines since the war has helped to hasten Canada's decision to return to a gold basis of international payments; Canada is the outstanding country of the world in which annual gold production is well in excess of that of pre-war times. Even the present Canadian annual output of gold of about $35,000,000 is, however, only a very small per cent of the large volume of financial transactions between this country and Canada. Not only is there large direct trade between the two countries, but since Canada is an exporter of commodities on balance to Great Britain and an importer of commodities on balance from the United States, and an importer of capital from both, various triangular credit transactions take place between the three countries. As is well known, American capitalists and enterprisers are constantly investing large sums of money in Canada either in the purchase of securities or in direct participation in Canadian enterprises. At the same time, Canadian banks even more than our own interior banks use loans in New York, principally to Wall Street, as a means of using their surplus funds and as a secondary reserve. The uncertainly shifting balances which all these transactions give rise to, have made it much more necessary for Canada to proceed with caution in returning to the international gold basis than would have been the case with a country which was more isolated economically, financially, or geographically.

The Federal Trade Commission has completed a report on the national wealth and income of the United States, and has published an abstract of the report. It estimates that in 1922 the wealth of the country was about 353 billion dollars, and the national income about 62 billions; the latter increasing in 1923 to about 70 billions. Of the total wealth, about 230 billions or 65% is assigned to real estate, and the remainder to tangible personalty or moveables.

The Commission did a sampling statistical job, and as part of its work sought from 10,000 corporations, and secured from 4,367 of these, figures of 1922 stockholdings. These corporations, with capital stock amounting to over 9 billion dollars (12% of that of all corporations) had 1,074,851 common stockholders, of whom over 90% were individuals. The average holding of common stock was $6,969, that of preferred stock $5,211. Nearly one-third of all stockholders reported on, held not more than $500 of stock (common and preferred) each; for petroleum companies, which had the highest proportion of such small holders among the industries covered by the reporting corporations, the figure was 53.8%. For all corporations which furnished the information, employee stockholders numbered 7.5% of all their common stockholders and 3.5% of their preferred stockholders, and held 1.5% of the common stock and less than 2% of the preferred.

* * *

In May, the annual report of President E. H. H. Simmons of the New York Stock Exchange was published. The report differs from its predecessors in containing a substantial amount of statistical information in the form of charts and tables. Compilations by the Statistical Department of the Exchange show that the market value of all securities listed on the Exchange rose from $60,684,000,000 on January 1, 1925, to almost $70,000,000,000 on January 1, 1926.

Of this increase a little less than half was caused by net additions to the list and something more than half by the rising prices of 1925. The increase in the value of stocks amounted to $7,417,000,000; that in the value of bonds by $1,897,000,000. On January 1, 1926, listings on the Exchange included the enormous totals of 491,615,837 shares of stock and nearly $37,000,000,000 par value of bonds. In an appendix to the report, figures are given showing the total value of sales contracts cleared by the Stock Clearing Corporation of the New York Stock Exchange, and the amount of money transfers saved by such operations. The table indicates that just about five-sixths of the value of the cleared contracts was settled without money passing. The funds or money transfers obviated by the clearing operations amounted during the year 1925 to no less than $33,695,000,000.

* * *

The American Bureau of Metal Statistics has published its valuable and interesting Year Book, the present issue being the sixth in the series. It is a statistical compilation devoted almost entirely to the non-ferrous metals, precious and non-precious, and especially to copper, lead, and zinc. Certain of the copper statistics for 1925 are particularly interesting in view of all that has been said in recent years about the "rising flood" of copper from South American and African mines, especially Chile, Katanga, Braden, and Cerro de Pasco.

According to the Year Book, world output of copper in 1925 reached a new high record level of 1,586,683 short tons, barely exceeding the previous high figure of 1,580,475 tons produced in the war year 1917. The 1925 output is given as 4% greater than that of 1924. Among the continents of the world (excluding Australia), the smallest absolute and relative gains over 1924 were made by South America, with Africa next; the greatest absolute gain was made by North America, and the greatest relative gain by Europe. The absolute gain

made by France exceeded that of the continents of South America and Africa together. The mines of the Iberian peninsula, which, according to historians, have been productive for 3,000 years, raised their output to the highest figure since 1912.

Counting those deposits in Spain and Portugal as one mine, we find (from the Year Book and other sources) that the 15 principal producing copper mines of the world contributed more than five-eighths of the world's output in 1925. Of these, only four made new high records in that year. Two of the four, the United Verde and the New Cornelia, were American mines; the other two were Chile and Katanga. The former two bettered their previous records by about 10%; the latter two by less than 4%.

* * *

The month of May completed a period of six months, in each of which the visible balance of German foreign trade was "favorable," with a total for the period of over 600,000,000 marks. This compares with an import or "unfavorable" balance of more than 2,400,000,000 marks during the same period a year previous. This reversal has been due partly to an increase in exports but principally to a decline in imports from 6,591,000,000 marks to 4,198,000,000 marks. For this, certain factors are chiefly responsible. In the first place, the large imports of 1924–5 accompanied large foreign loans to Germany. Second, Germany has been going through a severe depression, and periods of depression in any country generally witness decreased imports. Third, German industry has been endeavoring to institute economies of every sort and to increase productive efficiency, and meanwhile also not to increase but to work up existing stocks of raw materials for foreign as well as domestic sale. It would be rash to conclude that the "favorable" balance of trade will be permanent.

Abstracts of Recent Technical Papers from Bell System Sources

Complex Magnetization, by Eugene Peterson.[1] Magnetization of silicon steel by two sinusoidal fields of differing frequencies. The energy loss W per cycle and the flux density B associated with each of the two frequencies were determined when the two sinusoidal magnetizing forces were simultaneously impressed on a toroidal silicon steel core built up of one-mil laminations. A null method was used which permitted suppression of the modulated currents and constancy of the impressed currents during manipulation for balance. The frequencies used were 400, 821 and 1582. Six sets of measurements were taken with fixed magnetizing forces ranging from 0.5 to 10 gilberts/cm and superposed forces up to 15 gilberts/cm. The results show that the effect of superposition depends upon the relative amplitudes and upon the frequency ratio R of the superposed frequency to the other. At low fixed fields W and B go through maxima as the superposed field is increased, the maximum value increasing with R. The maximum is less pronounced or absent for the higher fixed fields. In general B is smaller with a low than with a high value of R other things being equal. The effect on W is not as sharply defined; in general the effect of superposition is more pronounced the higher the superposed frequency. The amplitude effect and frequency ratio effect are shown to be in general agreement with conclusions drawn from mathematical treatment of somewhat simplified cases and it is concluded that the effects are not inconsistent with purely hysteretic phenomena.

Some Photographic Problems Encountered in the Transmission of Pictures by Electricity, by Herbert E. Ives.[2] This paper considers some of the problems of photographic

[1] Physical Review, Vol. 27, pp. 318–328, March, 1926.

[2] Journal of the Optical Society of America and Review of Scientific Instruments, March, 1926, pp. 173–194.

tone reproduction, which arise upon the introduction of an electrical transmission system between a picture placed on sending apparatus in one place and the copy of the picture made by receiving apparatus in another place. Some of these problems arise because of limitations introduced by the use of the electrical transmission line; others arise because of opportunities for the control of picture quality which are not afforded by ordinary photographic methods. As an illustration of one of these limitations may be mentioned the fact that the original picture, for instance a photographic negative, is not seen by the operator at the receiving end. He cannot, therefore, by using his photographic knowledge and experience, choose printing media and decide upon conditions of exposure and development. As an illustration of the opportunities introduced by an electrical picture transmission apparatus may be noted the possibility of so poling the electrical elements that the received picture may be either a positive or negative, irrespective of the nature of the original at the sending end.

While in other picture transmission systems other problems arise peculiar to these systems, it is believed that although the questions considered are those presented in commercial operation in the Bell System, they are, to a certain extent, common to all electrical picture transmission apparatus.

A Radio Field-Strength Measuring System for Frequencies up to Forty Megacycles, by H. T. Friis and E. Bruce.[3] In previous types of radio field strength measurement apparatus it is very difficult to reproduce accurately the small comparison voltages at very high frequencies, due to reactive effects in the attenuating networks. The "tube voltmeter" is practically the only reliable instrument available at high frequency measurement work. New measurement sets for very high frequency signals have, therefore, been developed. The apparatus is a

[3] Presented at a meeting of the Institute of Radio Engineers, May 5, 1926.

double detection receiving set which is equipped with a calibrated intermediate frequency attenuator and a local signal comparison oscillator. The local signal is measured by means of the intermediate frequency detector which is calibrated as a tube voltmeter and all required attenuations are made at the relatively low and fixed intermediate frequency.

A New Mechanical Test for Rubber Insulation, by C. L. Hippensteel.[4] This paper discusses the development of a rapid routine test which will numerically express the ability of the rubber insulation to resist cutting by the conductor at the points of support and to resist cracking at points of extreme flexure. Up to the present time no one test of that nature has been described.

Power of Fundamental Speech Sounds, by C. F. Sacia and C. J. Beck.[5] This paper describes the continuing work on speech power by means of oscillographic studies of vowels, semi-vowels and consonants. A previous paper considered the characteristics of a few individual sounds from the power standpoint, but the principal emphasis was placed upon speech as a whole. In this later analysis, sounds are considered individually on the basis of instantaneous and mean power. A practical application of the results is suggested.

Neutralization of Telegraph Crossfire, by R. B. Shanck.[6] With the simple means here described for neutralizing mutual interference between parallel telegraph circuits, it has been found practicable to effect a reduction to 10 or 20 per cent of the original values. This has improved considerably the operation of some circuits and made available others which were otherwise unsuitable. The resulting improvement in transmission has made possible the elimination of certain intermediate telegraph repeaters with material savings. The neutralizing apparatus has no material effect when crossfire is not present, that is, when

[4] Industrial and Engineering Chemistry, April, 1926.
[5] Bell System Technical Journal, Vol. V, No. 3, 1926.
[6] Bell System Technical Journal, Vol. V, No. 3, 1926.

the paralleling wires are idle. It has been found that the use of arrangements here described on certain open wire circuits several thousand miles in length allows fast manual full-duplex operation where only medium-speed half-duplex operation was possible before. Furthermore, in the case of some cable circuits where it is impossible to operate more than two telegraph circuits per quad, it is now practicable to obtain four telegraph circuits.

Methods of High Quality Recording and Reproducing of Music and Speech Based on Telephone Research, By J. P. Maxfield and H. C. Harrison.[7] This paper deals with an analysis of the general requirements of recording and reproducing sound without appreciable distortion. The storing or recording of sound requires, first, a mechanical system which will respond faithfully to the sound waves which are to be recorded. Then there is required some material in or on which this sound may be recorded and an intervening system which permits the sound waves to make the record in this material. In the usual case, and in that which is particularly discussed, there is a mechanical system which will vibrate in response to the sound which is to be recorded and directly through some mechanical linkage, or less directly through an electrical linkage, drives a cutting mechanism which will impress a wax record.

The amount of power available to operate the recorder directly from the sound in the recording room is so small as to make the use of high quality electrical apparatus with associated vacuum tube amplifiers of very distinct advantage over the acoustic method.

Where the question of reproduction is concerned, the same two alternatives mentioned for recording present themselves, namely, direct use of power derived from the record itself vs. the use of electro-mechanical equipment with an amplifier. In this case, however, the situation is materially different since the power which can be drawn

[7] Bell System Technical Journal, Vol. V, No. 3, 1926.

directly from the record is more than sufficient for many uses. It is, therefore, generally simpler to design one single mechanical transmission system than it is to add the unnecessary complications of amplifiers, power supply and associated circuits. In cases where music is to be reproduced in large auditoriums, the power which can be drawn from the record may be insufficient and some form of electrical reproduction using amplifiers becomes necessary.

The paper points out, at length, how many of the heretofore unsolved fundamental problems of sound recording and reproduction have been readily solved by the application of a detailed knowledge of telephone transmission theory. The advances which have been effected in telephone transmission theory and in related electrical measuring apparatus in the last few years, have been so great as to surpass previous knowledge of mechanical wave transmission systems. The result is, therefore, that mechanical transmission systems of the type here considered, and perhaps other types, can be designed more successfully if they are viewed as the analogs of electric circuits. A detailed analysis is here made of the analogies between electrical and mechanical systems in the voice frequency range and a discussion of the resulting mechanical design is presented.

Operation of Thermionic Vacuum Tube Circuits, by F. B. Llewellyn.[8] Given the static characteristic of grid current-grid potential, and plate current-plate potential, for any three element vacuum tube, the general exact equations for the output current when the tube is connected in circuits of any impedance whatsoever, and excited by any variable voltage, are here derived. The method of derivation is illustrated in the special case where resistances only are considered, and the adaptation of complex impedance to use in non-linear equations is shown. Approximations that are allowable in various

[8] Bell System Technical Journal, Vol. V, No. 3, 1926.

practical applications are indicated, and the equations are applied in some detail to grid-leak detectors, and in brief to other types of detectors, modulators, amplifiers and oscillators.

Certain repetitions of previous work are contained in these pages, as it is believed that the applications of the novel features introduced are illustrated thereby better than by a description dealing only with new material.

Extraneous Interference on Submarine Telegraph Cables by J. J. Gilbert.[9] In order to avoid a considerable reduction in speed of operation, which would have resulted on account of the unusually large parasitic disturbances encountered in the neighborhood of New York, the New York-Azores permalloy loaded cable was equipped with a new type of earth connection consisting of a conductor extending 100 nautical miles to sea and there connected to earth through an artificial line.

This paper presents the theory of the new type of sea earthing arrangement and discusses the sources of extraneous interference and the manner in which it is picked up by submarine cables. A method is developed for estimating the magnitude of terminal extraneous interference in the case of any particular cable.

[9] Bell System Technical Journal, Vol. V, No. 3, 1926.

Notes on Recent Occurrences

A CELEBRATION of the fiftieth anniversary of the telephone, made notable alike by the fact that it was held almost within stone's throw of places that are famous in telephone history and by three striking features which illustrate the progress of telephone development, was held at the Boston City Club on the evening of April 15, 1926.

The presence of prominent telephone officials marked this as among the most important of many anniversary celebrations held or to be held during the present year. Addresses were delivered by Brig.-Gen. John J. Carty, vice president of the American Telephone and Telegraph Company, and by F. A. Stevenson, director of the Long Lines Department of the same company. Other speakers were Dean William M. Warren of Boston University and George S. Davis, vice president of the United Fruit Company.

Wire and radio telephony and talking moving pictures played important parts in the unusual program presented in addition to the addresses. In the course of his talk, General Carty "called the roll" of the telephone repeater stations on the Transcontinental Line from Boston to San Francisco, the guests listening to the demonstration through loud speakers.

Another interesting feature of the program was a brief address by Dr. Thomas A. Watson, who assisted Alexander Graham Bell at the time of the invention of the telephone, reproduced by means of talking moving pictures. Dr. Watson was shown standing near a table on which rested replicas of early telephone instruments and, as he talked, pointing out the interesting features of each instrument.

Both the transcontinental demonstration and the talking portion of the motion picture were broadcast through radio station WEEI, of Boston. This was the

first time in history that talking motion pictures and radio had thus been combined.

A similar anniversary celebration was held the following evening at Springfield, Mass. The principal speaker was Eugene S. Wilson, vice president of the American Telephone and Telegraph Company. Mr. Stevenson again represented the Long Lines Department of this company, and presided during the transcontinental telephone demonstration.

BENEFIT SECRETARIES' CONFERENCE

AT THE conference of the Benefit Committee Secretaries of the Bell System which was held at 195 Broadway, New York, from April 22 to 30, 1926, the time was devoted almost entirely to discussion of benefit work and its related activities as factors in the development of the individual employee.

The conference was attended by the benefit committee secretaries of all of the Associated Operating Companies and of the Bell Telephone Laboratories, the Graybar Electric Company and the Western Electric Company; by a number of personnel representatives and others who as members of benefit committees are closely identified with this work; and by members of the headquarters staff of the American Company.

In discussing the personnel policy of the Bell System at one session of the conference, Mr. E. K. Hall, pointed out the fact that the Benefit Plan and the work which has grown up around it is an outstanding illustration of that policy. This work, if wisely administered, presents unlimited opportunity for bringing out the best that there is in individual employees and cannot fail to make them realize that they are a part of the telephone business. The portion of the work which has to do with the prompt, accurate and sympathetic handling of benefit payments is of great importance, but of no less importance is the promotion of the preventive work, along the lines of thrift, health improvement,

etc., which aims to accomplish constructive results in the best development of each employee.

In other sessions, members of the conference from the associated companies and the American Company presented work which is being done or which is in course of development in the fields of thrift and insurance, health promotion, loans, etc., and throughout the discussions this thought of the constructive aim of the work was constantly emphasized. A substantial amount of time was devoted to certain forms of benefit committee organization, to methods of securing effective cooperation of the supervision in benefit administration, to the theory and application of workmen's compensation laws, and to the question of statistics and reports. In the discussion of each of these subjects the speakers made very clear their realization that the subjects which they presented are not ends in themselves but are means to be used in reaching the ultimate objectives of Benefit work.

At the conclusion of the conference it was suggested that the spirit of the proceedings could be summarized by saying that two main facts had been clearly brought out:

(1) That the only way the benefit job can be done right, and be of permanent, constructive value to telephone employees and to the telephone business, is by making certain that it is handled in the right way at the point where it reaches the individual employee—that is, in the contacts between employees and supervision.

(2) That the only way this can be accomplished is by making certain that the supervision realizes the broad, helpful purpose, aimed at individual development, which underlies the benefit provisions and the entire personnel policy of the Bell System.

1926 OPERATING CONFERENCE

FROM May 5 to May 13 a conference was held at Absecon, New Jersey, which was attended by the head of the Operating Department, either Vice President or

General Manager, of each of the operating units in the Bell System. These operating units are twenty-five in number extending from New England on the east to the Pacific coast on the west and from Canada on the north to the Gulf states on the south and all were represented. The conference was also attended by the principal staff officials of the American Telephone and Telegraph Company.

The results of operation for 1925 were discussed in detail, as well as the prospects and the program for 1926 and for subsequent years. The results for 1925 showed gratifying improvement over the preceding years, and further opportunities for improvement in 1926 and subsequent years were noted and fully discussed. While it is generally recognized that telephone service rendered to the public in the United States and Canada far excels both in extent and in quality that to be found elsewhere in the world, a noticeable feature of the conference was the confident feeling on the part of all that by intensive effort still further substantial improvements in our service could be made.

Service was analyzed particularly from the viewpoint of the customer, both in its application to the work of the various departments and from a non-functional viewpoint, and plans for further work along this line were discussed and formulated.

The importance of rendering a service which is not only technically good but which has the necessary personal touch to be pleasing to the individual subscribers was also an important item in the work as planned by the conference.

Careful study was given to the subject of calls which are not completed on the first attempt due to such causes as busy subscribers' lines, failure of subscribers to answer, operating or subscribers' irregularities. Ways and means of improving the service on calls of this nature were discussed. It was the feeling of the conference that intensive work on the part of all departments should

result in an improvement both in the handling of these calls and in the percentage of calls completed on the first attempt.

The results show a continued improvement in the handling of toll calls which has been most marked in cases where calls have been transferred from the toll board to be handled on the local boards by the A-B method and where the new combined line and recording method has been introduced. The improvements that are being realized emphasized the importance of carefully worked out programs in order to get all possible traffic transferred to these methods as soon as the necessary equipment changes can be made.

Other items in which gratifying improvements were shown were the reductions in orders delayed by lack of facilities to a small number and in the time taken from a request for a telephone until it is installed. It was felt, however, that in many cases still further improvement could be made particularly in the installation interval.

Machine switching installation was shown to have continued according to previous plans—500,000 machine switching stations were added during the twelve months ending April 30, 1926, bringing the number of these stations at the present time up to 1,600,000 out of a total of 12,000,000 stations operated by the Associated Companies.

In view of the important work accomplished at the conference and the desirability of following up closely the work programmed, it was the unanimous recommendation of the conferees that at least for the immediate future an Operating Conference should be held each year.

PLANT AND ENGINEERING CONFERENCE

A CONFERENCE of the Chief Engineers and General Plant Managers of the various companies comprising the Bell System was held from June 2 to 11,

inclusive, at Buckwood Inn, Shawnee-on-Delaware, Pa. Besides the members from the operating units, representatives of the Western Electric Company, Northern Electric Company, Bell Telephone Laboratories and the American Telephone and Telegraph Company also took an active part in the conference program. During the first part of the conference, the Personnel Representatives of the various companies were in attendance and two days were devoted to review and consideration of personnel problems, particularly as related to the plant forces.

The results of operations for 1925 were reviewed in detail and showed gratifying improvement over preceding years. The many important engineering and plant operating problems now before the System were fully discussed, particularly with a view to effecting still further improvements in efficiency of operation and service.

The growth and increasing complexity of the plant, together with the decrease in the purchasing power of the dollar, have necessarily resulted in an increased investment per station. Particular attention was given to this phase of the problem in order that the investment might be held at a minimum consistent with having adequate facilities available as required.

Many suggestions were discussed with respect to specific ways of improving service as it is viewed by telephone users. These suggestions concerned many matters besides those that are technical, such as, for example, the question of so organizing the forces that telephone subscribers will receive a more personal touch in all their contacts with the company.

In discussing the opportunities for improving both service and performance, particular stress was laid on the value of an adequate plant staff to assist the line forces. With the increasing complications of the plant, both as to size and technical methods and apparatus, the need for this staff group has become increasingly

important. The discussion with respect to the personnel which is required on such staff work and as to the methods which have been found most effective in carrying out this staff function, was comprehensive and helpful.

The desirability and importance of definite advance programming of all engineering and plant operating activities came in for full discussion.

It was the feeling of all that the conference had been helpful in pointing out opportunities for obtaining still better results in the future both from the subscriber's point of view and from the standpoint of overall results of operation.

THE EDUCATIONAL CONFERENCE

CONSIDERATION of mutual interests in men, money and materials in the telephone industry was the chief purpose of the Third Educational Conference, held at 195 Broadway, New York, June 21–25. These problems of the Bell System, presented from the standpoint of economics and business rather than the technical and engineering point of view of the two previous conferences, were discussed by about ninety representatives of sixty Colleges of Liberal Arts and Collegiate Schools of Business, together with Bell System personnel and employment supervisors.

At the opening session, Mr. H. B. Thayer spoke on "The Bell System—Historical Background, Ideals, Policies and Organization." In this address the keynote of the conference was sounded.

"We must maintain an organization to study critically our present methods and to devise new and better ones. This means that we must provide an adequate supply of trained supervisory officials. We must schedule the production of general managers and the supervisory staff as we do the supply of buildings and switchboards."

Since the telephone originally was the outgrowth of scientific endeavor and has been continuingly so during

its fifty years of existence, the first day's program was devoted to that aspect of the business. Dr. F. B. Jewett, in an address, "Economic Aspects of Scientific Development," discussed relationship of business and its dependence upon the knowledge of physical things. Mr. E. B. Craft discussed the budgetary control under which the Bell Laboratories operate, and pointed out that the Laboratories are primarily concerned with designing devices and systems to use rather than to sell. "Economic Problems of Scientific Development" was the subject of talks and illustrations by five engineers at the Laboratories, after which an inspection trip followed.

A close range view of telephone operating problems was given by a visit to the local and long distance offices at 24 Walker Street. Mr. B. Gherardi later presented a broad outline of the operating problems in which four objectives of the Bell System were enunciated—to give better, more comprehensive and more satisfying service; to do the most for and to bring out the best in its 350,000 employees; to provide a fair return for its investors, and constantly to develop the telephone art. He stressed the fact that providing telephone service, unlike many other kinds of public utility services, is essentially an individual matter and that subscribers must be served as individuals and not as groups. The functions and management problems of the Traffic Department were discussed by Mr. K. W. Waterson; the work of the Commercial Department by Mr. L. B. Wilson, and Engineering and Plant Department operations by Mr. R. H. Burcher.

The economic and business aspects of manufacturing and purchasing to meet the needs of a nationwide telephone service were topics at the third day's session. The evolution of the Western Electric Company from a small organization, founded in 1869, to its present proportion, each step of which has been taken to keep pace with demands for telephone service, were described by Mr. H. A. Halligan. Mr. W. S. Hosford outlined the economies effected through carefully engineered methods of manu-

facturing, citing the illustration of the new method of making hard-drawn copper wire which is used in enormous quantities for telephone purposes. The functions of the Western Electric Company, as purchasing agent for the System, said to be the biggest purchasing job ever undertaken by a single organization, were discussed by Mr. J. B. Odell, while problems of merchandising were outlined by Mr. F. H. Leggett. At an evening session, Mr. C. G. Stoll, on the subject "The Work Shop," told of the many and varied activities at the Hawthorne manufacturing plant. Mr. C. G. DuBois discussed the relationship of business and science, stressing the fact that a high standard of integrity must continually be maintained in business relations. He also suggested that, whereas in the past the telephone industry had given particular attention to the physical sciences and made substantial progress thereby, it is not unlikely that in the future it will be necessary to make use of the social sciences and take advantage of the contributions of these sciences to business and business organization.

On the subject "Planning For Future Operations," Mr. Gherardi further considered those operating problems which are necessary in taking care of the future growth of America's nationwide telephone system to meet constantly increasing public demands for service. "Planning ahead is an integral part of management and cannot be regarded as a job separate and distinct from the other phases of the job, but is before one at all times. The natural growth and development of the country, the growth of the telephone habit and changes in the state of the telephone art are factors to be always kept in mind." Mr. Gherardi concluded his address by discussing the fundamental plan, the commercial survey, the provisional estimate and the five year estimate.

The financial aspects of providing for the extension of service to meet future demands were discussed by Mr. D. F. Houston. The general trend in business toward a widespread diffusion of ownership was analyzed. The

fact that there are 371,000 stockholders in the Bell System changes the problem of financing as compared with that of companies owned by a small group. Other papers at this session dealt with the place of statistics and economic research in the telephone business, the general subject being presented by Mr. J. F. Behan. His address was supplemented by a presentation, through the use of tables and charts, of a few examples of actual performance and cost analyses by Mr. S. L. Andrew of the American Telephone and Telegraph Company, and Mr. E. E. Lincoln of the Western Electric Company. At an evening meeting, Mr. E. S. Bloom spoke on "General Considerations Affecting Rates and Regulation." Dean E. E. Day of the School of Commerce, University of Michigan, also spoke on the subject "Our Mutual Interests."

The concluding day's program centered about the subject of men, that is, personnel problems in the Bell System. Mr. E. K. Hall spoke on "General Personnel Problems and Policies," and Mr. R. I. Rees on "The Selection and Development of Personnel."

Throughout the conference considerable discussion was prompted by many questions on the part of the guests as to particular methods and procedure involved in carrying on the telephone business. Dean C. O. Ruggles of Ohio State University, Dean Stuart Daggett of the University of California, and Professor W. H. Kiekhofer of the University of Wisconsin, gave, in short addresses, an expression of the value of the conference as a means of furnishing first-hand information and insight into the problems and spirit of a great business enterprise, thereby equipping the visitors for better instruction of young men studying economics and business courses.

HONORARY DEGREES FOR EDWIN H. COLPITTS AND EDWARD B. CRAFT

EDWIN H. COLPITTS, of the American Telephone and Telegraph Company's Department of Development and Research and Assistant Vice-President of the

company, received the degree of LL.D. from Mount Allison University, Sackville, N. B., at the university's convocation on May 18, 1926. Mr. Colpitts was graduated from Mount Allison in 1893 with the degree of A.B. Continuing his studies at Harvard University, he received there the degrees of A.B. in 1896 and M.A. in 1897. Before joining the American Telephone and Telegraph Company's general staff, he was Assistant Chief Engineer of the Western Electric Company from 1917 to 1924.

The degree of Doctor of Engineering was conferred June 18, 1926, by Worcester Polytechnic Institute upon Edward B. Craft, Executive Vice-President of the Bell Telephone Laboratories. In the award of this honorary degree, Mr. Craft was described as "engineer, inventor and organizer of research, one of the most prominent figures in the engineering world today. For over a quarter of a century he has devoted his unusual organizing ability continuously to engineering development and industrial research, with results that have increased the social and economic significance of research and brought him to his present important position as Executive Vice-President of the Bell Telephone Laboratories, which are the largest industrial research laboratories in the world."

THE A. T. AND T. STOCK ISSUE

AT their meeting on May 19 the directors of the American Telephone and Telegraph Company voted to offer to stockholders of record June 8 for subscription at par one share of additional stock for each six shares then held. This offering, which amounted to $154,000,000, was made to 370,000 stockholders who have until August 1 to exercise their right to subscribe for the new stock.

The purpose of the new issue is to provide the Bell System with funds for new construction needed to care for additional business resulting from the constantly greater use of the telephone.

HENRY F. ALBRIGHT

HENRY FLEETWOOD ALBRIGHT, Vice-President of the Western Electric Company, died at the Memorial Hospital, New York, on Tuesday, May 11, after an illness of several months.

Mr. Albright was fifty-eight years old and had been associated with the Western Electric Company for thirty-four years. He began his business career as an office boy, his first employment being with the Union Pacific Railroad in Philadelphia. He joined the Western Electric forces in 1892 as a salesman of electric light and power apparatus in Chicago. In 1894 Mr. Albright was transferred to the Construction Department in New York. Three years later, in 1897, he was made the first Factory Engineer the Western Electric ever had, and in 1899, was made Superintendent of the New York shop. In 1908, four years after the Hawthorne plant was started, he became General Superintendent and directed Hawthorne during its greatest period of expansion.

In 1917, Mr. Albright was elected a Vice-President, and in 1919, a member of the Board of Directors. Since 1923, he had served as Vice-President in charge of Manufacturing and Plant Engineering.

Mr. Albright was a member of the Union League Club of Chicago, the Oak Park Country Club, the Institution of Electrical Engineers of London, a Fellow of the American Institute of Electrical Engineers, and a member of the American Society of Mechanical Engineers.

FRANZ C. KUHN

FRANZ CHRISTIAN KUHN, President of the Michigan Bell Telephone Company, died at Detroit, Michigan, June 16, 1926.

He was born in Detroit, February 8, 1872. He went with his parents when a child to Mount Clemens, Michigan, and was known as a resident of that city. He was educated in the local schools and at the University

of Michigan where he received the degrees of A.B. in 1893 and L.L.B. in 1894.

In the latter year he was elected to the office of Circuit Court Commissioner of Macomb County, a post which he filled for three consecutive terms. In 1904 he was elected Probate Judge, to which office he was reelected four years later, and in 1910 was appointed Attorney General of the state, an office that had been vacated. Later in that year he was elected to a full term as Attorney General.

A vacancy occurred in the State Supreme Court in 1912, and Judge Kuhn was appointed to fill it. He was elected in 1913 for an unexpired term and in 1917 was elected for a full term, serving as Chief Justice from 1917 to 1918. Retiring to the private practice of law in December, 1919, he was offered the presidency of the Michigan Bell Telephone Company, which he accepted in February, 1920.

Judge Kuhn was a director of several Detroit corporations, a member of the American Bar Association, the Michigan Bar Association, the Phi Delta Theta Fraternity, many Detroit social and athletic organizations, was active in Masonic circles and was Past Grand Chancellor of the Michigan Knights of Pythias.

CHARLES EZRA SCRIBNER

CHARLES EZRA SCRIBNER, for twenty-two years Chief Engineer of the Western Electric Company, died on Friday, June 25, at his summer home, Barber Farm, in Jericho, Vt. Mr. Scribner was a life-long friend of Thomas A. Edison and, with the exception of Mr. Edison himself, probably had more electrical patents than any other man in the industry. He held 441 patents, including the first multiple switchboard to be used commercially.

He was born at Mt. Vernon, Ohio, on February 16, 1858, and was educated in the schools of Toledo, Ohio.

When only eighteen years of age, he went to the Chicago factory of the Western Electric Manufacturing Company to show a model of a telegraph repeater he had made.

There he met Enos M. Barton, the head of the organization, and through the latter's influence, he became an inspector of printing telegraph apparatus in a local telegraph company. A year later, in August, 1877, he entered the laboratory of the Western Electric Manufacturing Company where he began his career as an investigator and inventor, a career that brought him international fame.

Mr. Scribner remained at the Chicago factory of the Western Electric Company until 1908, when he became connected with the New York office as Chief Engineer in charge of development and experimental work. He served as Chief Engineer until 1916, when he retired.

In 1900 Mr. Scribner's work in the electrical field was recognized at the Paris Exposition by the award of a gold medal. He was a Fellow of the American Institute of Electrical Engineers, and in 1913–15, served as Vice-President. He was also a member of the Engineering Foundation, and a former trustee of the United States Engineering Society.

Organization Changes

New York Telephone Company

Charles T. Russell elected Vice-President and General Counsel

Entered employ of the Bell System in Legal Department, New York Telephone Company, 1906; appointed Counsel, 1911; General Solicitor, 1915; General Counsel in charge of all legal, public service commission regulation, tax and legislative matters, 1922; Vice-President and General Counsel, 1926.

Bell Telephone Company of Pennsylvania and Associated Companies

Frank J. Chesterman elected Vice-President and appointed General Manager for Western Pennsylvania

Entered employ of the Bell System with the American Telephone and Telegraph Company in Boston, July 5, 1905; assigned to work on special investigations involving the maintenance of telephone plant with special reference to transmission, 1905; transferred to the Engineering Department, New York Telephone Company, June, 1907; Division Plant Engineer, Manhattan, Bronx and Westchester Division, January, 1908; Division Plant Superintendent of the Central Division, with headquarters at Syracuse, October, 1912; Chief Engineer, the Bell Telephone Company of Pennsylvania and Associated Companies, January, 1920; elected Vice-President and appointed General Manager for Western Pennsylvania, May 1, 1926.

Marshall B. Downing appointed General Manager, Eastern Pennsylvania excluding Philadelphia exchange, Delaware and Southern New Jersey

Entered employ of the Bell System as Traffic Inspector, New York Telephone Company, November,

1899; Manager, Franklin exchange, New York City, 1901; served as Supervisor of the traffic field forces in the district extending from Troy to Lake Champlain, of the Traffic Department of Rochester and surrounding territory, of the Albany district, and as Acting Superintendent of Traffic for the New Jersey Division, New York Telephone Company; transferred to Southwestern Bell Telephone Company as General Traffic Superintendent in Missouri and Arkansas, November, 1912; transferred to the Michigan Bell Telephone Company as General Superintendent of Traffic, 1916; transferred to Bell Telephone Company of Pennsylvania as General Superintendent of Traffic, December, 1919; General Commercial Manager, March, 1923; General Manager, Eastern Pennsylvania, exclusive of Philadelphia exchange, May 1, 1926.

Herbert L. Badger appointed General Manager for Philadelphia

Entered employ of Bell System as Assistant in charge of telephone work in Drafting Department, Western Electric Company, New York, February, 1897; resigned, November, 1901; re-entered the Bell ranks, Engineering Department, Bell Telephone Company of Pennsylvania, March 24, 1902; Plant Superintendent in Scranton, July, 1909; District Superintendent of Plant in charge of Scranton, Allentown and Wilkes-Barre districts, 1910; Plant Superintendent in charge of plant operation in the Pittsburgh Division outside of Allegheny County; Division Superintendent of Plant, Pittsburgh, April, 1915; General Superintendent of Plant, 1919; General Manager for Philadelphia, May 1, 1926.

John T. Harris appointed General Manager for Central Pennsylvania

Entered employ of Bell System as an installer for the Central Pennsylvania Telephone and Supply Company, October, 1898; District Manager at Philipsburg, Pa.,

January 1, 1900; Manager at Altoona, Pa., 1901; Traffic Superintendent for the Pennsylvania Telephone Company, Harrisburg, January, 1907; Division Traffic Manager, Bell Telephone Company of Pennsylvania in charge of Harrisburg Division, 1908; Traffic Superintendent, Harrisburg, February, 1914; Traffic Superintendent, Pittsburgh, 1920; General Traffic Manager, Bell Telephone Company of Pennsylvania, March, 1923; General Manager for Central Pennsylvania, May 1, 1926.

INDIANA BELL TELEPHONE COMPANY

Frank A. Montrose elected Vice-President and General Manager

Entered employ of Bell System, Chicago, Ill., 1907; various duties in plant and engineering departments of the Plant Department, Pacific Telephone and Telegraph Company, Missouri and Kansas Telephone Company and Southwestern Bell Telephone Company, up to 1917; commissioned a Major and organized the Four Hundred and Twelfth Telegraph Battalion, 1917; returned from overseas with rank of Lieutenant-Colonel, 1919; Central Union Telephone Company, 1919; served as General Superintendent of Plant, Indiana Bell Telephone Company, and was made General Manager, May 1, 1925. Vice-President and General Manager, May 1, 1926.